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Dead on Arrival?
*The Development of the
Aerospace Concept, 1944-58*

STEPHEN M. ROTHSTEIN, MAJOR, USAF
School of Advanced Airpower Studies

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Abstract

First impressions are lasting impressions. In late 1958 Air Force Chief of Staff Thomas D. White first evoked the term *aerospace* to describe to the nation how America's airmen perceived their operational environment. "Air and space are not two separate media to be divided by a line and to be readily separated into two distinct categories; they are in truth a single indivisible field of operations." Unfortunately, also by the end of 1958, organizational architecture, national legislation, and national policy were in place to indicate that an alternative paradigm would take precedence over that of the Air Force. This study chronologically traces the historical development of the aerospace concept, from its initial inception in 1944 as it was embodied in the far-reaching vision of Gen Henry H. "Hap" Arnold, until its public appearance in 1958. This study also uncovers reasons why airmen came to see their primary area of responsibility differently than the rest of the nation and why their aerospace concept failed to win bureaucratic support. By tracing the aerospace concept's technological and intellectual development against a contextual backdrop of geopolitics, national security strategy, national space policy, interservice competition, and internal tensions within the Air Force, this paper offers historical lessons learned for today's planners seeking to move the Air Force toward an aerospace force.

About the Author

Maj Stephen M. Rothstein, a senior pilot with more than 2,300 flying hours, was commissioned through the United States Air Force Academy (USAFA) in 1984. Graduating from undergraduate pilot training in 1985, he was assigned to fly F-111s, in which he completed two operational tours of duty. A graduate of the Fighter Weapons School, he was subsequently selected to become an exchange officer with the German Air Force, where he flew the Tornado as an instructor in their Fighter Weapons School. Upon return from his exchange assignment, Major Rothstein served as a brigade air liaison officer with the Army's 3d Infantry (Mechanized) Division. He holds a bachelor of science degree in humanities from USAFA. Major Rothstein, a graduate of Air Command and Staff College and the School of Advanced Airpower Studies, is currently pursuing a doctoral degree in international security studies at the Fletcher School of Law and Diplomacy, Tufts University, Medford, Massachusetts. Major Rothstein is married to DeeAnn, has a daughter, Rebecca, and a son, Casey.

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Chapter 1

Introduction

On 4 October 1957, the Soviet Union launched the world's first man-made satellite into orbit around the earth. Through the lens of the cold war, different perspectives yielded different reactions. It was at once a triumph and a defeat—technologically, militarily, politically, and ideologically. But few would deny the fact that sputnik, having left its earthbound environment, symbolized the popular notion that the space age had begun. One who did view this notion differently, however, was the United States Air Force's (USAF) chief of staff, Gen Thomas D. White.

The month following sputnik, General White publicly expressed an alternative environmental view with regard to space. In a speech to the National Press Club titled "Perspective at the Dawn of the Space Age," General White presented the airman's perspective. "Total airpower," he said, "is the sum of a nation's aeronautical and astronautical capabilities." He described "the third medium" as "the medium of space above the earth's surface," adding that "I want to stress that there is no division, *per se*, between air and space."¹ By the summer of 1958, a word had emerged from within the Air Force that clarified this concept—*aerospace*.² General White evoked the term later in the year to fundamentally disagree with the general notion that a new era had begun.

Air and Space are not two separate media to be divided by a line and to be readily separated into two distinct categories; they are in truth a single indivisible field of operations. Space is the natural and logical extension of air; space power is merely the cumulative result of the evolutionary growth of air power. It would be more accurate, rather than to speak of two separate and distinct eras, to adhere to a more descriptive frame of reference, one which would clearly show these phases of man's entry into the universe in their proper perspective. Precisely speaking, we are and have been operating in the "Aerospace Age." . . . From the first military aircraft to enter the inventory—the Wright brothers' pusher-type, skid-equipped airplane—to the futuristic X-15 unveiled in 1958, Air Force goals have changed in degree only; the basics have been constant—greater speed, longer range, and higher altitude.³

General White deserves the credit for introducing the aerospace concept to the American public. But aerospace was the Air Force's concept alone.

Other American military perspectives saw no intellectual foundation for joining air and space in a word. Some considered the term farcical. Take, for example, this testimony before the House Committee on Science and Astronautics on 9 February 1959. Congressman John McCormack's question precedes the response from Maj Gen Dwight E. Beach, US Army, of the Office of the Deputy Chief of Staff for Military Operations.

Mr. McCormack: We have heard witnesses of another service use the term "aerospace." What service do you think should have overall responsibility for military space activities?

General Beach: Well, I never heard of that term before. I always heard of "armospace." . . . Congressman McCormack, I don't believe any one service should

have overall responsibility. It should be a national effort. . . . the Army has specific requirements in space, and our position is that no single military department should be assigned sole responsibility for military space operations.⁴

Nor did national leadership support the aerospace concept. National Security Council (NSC) 5814, *Missile and Space Programs*, established as national policy on 20 June 1958, recognized the area above the earth's surface as "divided into two regions: 'air space' and 'outer space.'" It further declared that while America would continue to exercise the right to defend its national security, America's intention was that space "be used only for peaceful purposes."⁵ Space in the eyes of the nation's leaders, unlike those of its airmen, was not an "indivisible field of operations." As America was realizing an ability to venture beyond the reaches of the atmosphere, an environmental paradigm existed outside of the Air Force that recognized space to be different from the atmosphere, separate and distinct—physically, militarily, and politically.

There is little written that addresses the intriguing disparity between how America's airmen came to view their world so differently from its soldiers, sailors, and leaders. Though the history of American space development is still young, scholars have poured over it in excruciating detail. Many stories already fill the shelves capturing the evolution of technologies, detailing the experiences, or analyzing the influential decisions that led man into space. More recently, with the fall of the Berlin Wall and the emergence of the cold war's deeper secrets, broader, grander analyses have begun to appear. But few works question issues pertaining to how space developed conceptually—perhaps because today's accepted concepts are the norm, and few disagree with them.

General White first articulated the aerospace concept publicly in the late fifties. But evidence clearly supports that airmen were beginning to think with an aerospace perspective as soon as the *potential* of developing technologies enabled them to, well before the appearance of the word itself. How then—amidst the other services and beneath an overarching national policy perspective that saw otherwise—did the aerospace concept nevertheless develop? What events, issues, and decisions shaped it? Did it indeed fail, as a concept, to take hold? And if so, why?

This study seeks answers to these questions. Its findings are relevant in the historical sense as they add perspective to the existing body of knowledge. More importantly, the findings have relevance today. At present, "space for peaceful purposes" remains the cornerstone of America's space policy; and the nation's military is organized to indicate that space remains different from the atmosphere. And yet aerospace, in the minds of current Air Force leadership, continues to remain a valid construct. Furthermore, the Air Force is presently initiating a drive to realize General White's vision of 40 years ago.

Last year Gen Michael E. Ryan, the Air Force chief of staff, issued a memorandum to top-level commanders throughout the Air Force. It began, "At CORONA South 98, the senior Air Force leadership committed to the integration of air and space power into an aerospace force." In the message, General Ryan directed the establishment of the Aerospace Integration Task Force (AITF), built from the Air Force's "best 'aerospace' thinkers." The task force's objective: "Build a single, consolidated plan

that will provide continued integration of air and space power and orderly migration to future capabilities which best exploit the seamless aerospace dimension.”⁶ While much has changed over 40 years to support the Air Force’s addressing the potential for institutionalizing the aerospace concept, significant continuities remain to suggest there is value in drawing pertinent lessons from this period of the past.

To extract some of these lessons, this author examines the 14-year “gestation” period during which the Air Force’s aerospace concept developed. The analysis enters during the midforties, when sufficient evidence appeared to indicate that airmen began realistically thinking about space. It ends with the appearance of General White’s description of the “third medium,” by which point national policy, legislation, and organizational structures were sufficiently in place to support the notion that the aerospace concept had not taken hold outside of the Air Force.

Tracing the development of an intellectual concept that, through most of the period under analysis, does not have a name requires as much as anything the capture of the zeitgeist—the spirit or context of the time. Therefore, this author employs a historiographic methodology for this survey. He constructs a narrative history that examines the contextual factors, events, and decisions germane to the study’s focus. Throughout this narrative, five interrelated themes that had bearing upon how airmen viewed their world are traced.

- The influence of external, top-down contextual factors which determine the financial support for, and in some respects, the nature of America’s force structure. In this regard, I mean to address the broad interrelationships between geopolitical factors, national security strategy, and the national economy.
- The development of technologies that enable the domain of space to be made available.
- The influence of external, horizontal contextual factors against which the aerospace concept must compete. Here my intent is to capture the interservice and interagency tensions that vie amongst each other for national resources and support.
- The development and influence of national space policy.
- The influence of internal, bottom-up organizational factors within the Air Force which directly affected the aerospace concept’s development. Relevant here are issues such as theory and doctrine, intracultural biases and interests, bureaucratic forces, the role of subordinate units within the organization, and the influence of key individuals.

Together, these themes describe the external and internal dynamics that influenced the development of the aerospace concept.

To identify and describe the concept itself, I examine three interrelated elements that collectively characterize its evolution during this period. The “push” element of the aerospace concept describes the technical capacity available or developing within the Air Force that supports the concept’s realization. Second, the concept’s “pull” element identifies the existing in-

tellectual justification for an aerospace paradigm. Thus the focus is on the development of organizational vision and airpower theory.⁷ Together, the push and pull elements share a symbiotic relationship—each depends on the existence of the other in order to survive. However, this relationship, especially during its infancy, was critically dependent upon the focus of Air Force leadership for its nourishment and growth. Leadership focus thus constitutes the third element examined in order to identify the progress of the aerospace concept from 1944 to 1958.

The body of this study contains four chapters—the first three devoted to historical narration, the fourth to analysis. Chapter 2 enters the narrative in the final year of World War II and moves through to July 1947 when the Air Force gains its independence. Chapter 3 continues with the remainder of the Harry S. Truman presidency. Chapter 4 begins in 1953 as Dwight D. “Ike” Eisenhower assumes office and ends six years later when General White introduces the word *aerospace*. Together, these three chapters tell a continuous story that presents and organizes the evidence. Chapter 5 then offers a summary and analysis of the entire body of evidence with respect to the themes mentioned above. It discusses the general observations emerging from the study that offer answers to how airmen came to see the vertical dimension differently and why their perspective was generally rejected in favor of one that separated space from air.

To conclude, the final chapter draws the study’s lessons forward. Chapter 6 explores some implications that are perhaps relevant to the Air Force both for today and in the future.

There are three obvious limitations to this study and one not so obvious that significantly qualify its conclusions. The first concerns the limits the choice of methodology imposes. This structure enables flexibility to span a broad range of issues over a large period of time. It is not a scientific approach that uses a conceptual model to support the validity of the conclusions. Thus, I sacrifice explanatory power but gain breadth. My intent is to provide insight, not proof. Second, in limiting this examination to a 14-year period of history, I exclude the more immediate 40. While “first impressions are lasting impressions”—and despite the existence of continuities that enable me to span this gap—the interim period brings many issues to bear on the topic, but they are not addressed. These issues are left for further study. Third, the span of themes limits the amount of attention that can be given them. To a large extent this problem is alleviated by relying on the secondary work of scholars and historians who have accomplished more detailed and specific studies. In this regard, a synthesis is provided.

Fourth, the final not so obvious qualifier regards Harvard historian Frederick Merk’s warning not to “overemphasize the ‘idea’ in history.” To paraphrase Merk in the context of this study, pulling the development of the aerospace concept out of history in retrospective analysis tends to make the concept loom larger than it actually was. This problem, cautions Merk, is particularly troublesome given how “the ‘idea’ as tenuous as” the concept of aerospace existed as it did during this period in history.⁸ The fact that aerospace was never an idea that airmen felt a need to defend, let alone articulate, until 1958 makes Merk’s warning significant. To

deter, as much as possible, this inherent bias from entering this study, an uncharacteristically high value is placed on articulating a more complete zeitgeist than might normally be considered necessary. How well I have succeeded, or not, in this regard will no doubt be a central issue of critique. Given these four limitations—the study's methodology, its limited period but broad focus within that period, and its focus on a historical idea—my conclusions, especially with respect to their relevancy today—are offered as food for thought.

This study is not an argument to justify or refute the aerospace concept. The intent is to describe a set of circumstances, to tell a story, and provide insight as to why it concludes as it does. Where I offer observations for the Air Force today, I inherently assume the aerospace concept to be valid—not because I have proven it to be so but rather because indications are that the Air Force believes that it is.

That being said, a definition of "it" is in order. My definition for the aerospace concept is drawn directly from General White's discussion more than 40 years ago. "Air and space are not two separate media to be divided by a line and to be readily separated into two distinct categories; they are in truth a single indivisible field of operations." This definition is consistent with the Air Force's official position today. The AITF will soon release a document that provides the theoretical foundation for the integration of air and space. In it, aerospace is defined as "the seamless operational medium that encompasses the two physical environments of air and space."⁹

Finally, for simplicity's sake some liberty is taken with the term *Air Force*. This is relevant for chapter 2 where events and issues are presented that occurred before the National Security Act of 1947. Where it is significant to distinguish between the Army Air Service or Air Corps and the USAF, I do so historically consistent with organizational nomenclature. Where it is not, however, "Air Force" is used for clarity, although the name might not be accurate for the time.

Eisenhower deserves credit for developing the foundations of America's space program as we know it today. The basic structures of its policy and current organizational institutions were established during his final three years in office. But it is a space program, not an aerospace one. To examine the reasons why the Air Force's aerospace concept may have failed to take hold, we must examine its origins, trace its development, and recognize the nature of the forces working against it within and around the geopolitical, national, and relevant military organizational context of the times. To accomplish that, this study begins in the final year of World War II. While President Truman was preparing America for its new role as the leader of the Free World, the aerospace concept was born.

Notes

1. Thomas D. White, "Perspective at the Dawn of the Space Age," in *The Impact of Air Power: National Security and World Politics*, ed. Eugene M. Emme (Princeton, N.J.: Van Nostrand, 1959), 497–98.

2. Frank W. Jennings, "Doctrinal Conflict over the Word *Aerospace*," *Airpower Journal*, Fall 1990. The full story behind how the term *aerospace* was born can be found in this article written by the person who claims to have first introduced it.
3. Thomas D. White, "The Inevitable Climb to Space," *Air University Quarterly Review* X, no. 4 (Winter 1958-59): 3-4.
4. House, *Missile Development and Space Sciences: Hearings before the Committee on Science and Astronautics*, 86th Cong., 1st sess., February and March 1959, 76-77, in Jennings, 47-48.
5. National Security Council 5814, *U.S. Policy on Outer Space*, 20 June 1958, in John Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1: *Organizing for Exploration* (Washington, D.C.: National Aeronautics and Space Administration History Office, 1995), 347, 350.
6. Michael E. Ryan, United States Air Force (USAF) chief of staff, memorandum, subject: Aerospace Integration Plan Task Force, 13 April 1998, atch. 2, 1.
7. The author excludes doctrine from this framework on the inherent assumption that while doctrine and theory are intimately related, doctrine derives its foundation from operational experience, which throughout this study remains nonexistent.
8. Frederick Merk, *Manifest Destiny and Mission in American History* (New York: Vintage Books, 1966), 225.
9. USAF, Directorate of Plans and Programs, "Beyond the Horizon: Integrating Air and Space," report prepared by the Aerospace Integration Task Force (draft), 20 February 1999, 3-1.

Chapter 2

Aerospace's Nascency (1944-47)

We have a new weapon of unusual destructive force.

—President Harry S. Truman
(to Premier Joseph Stalin, Potsdam, July 1945)

Airmen began to visualize their operational domain as extending beyond the atmosphere coincident with a growing recognition of the potential of rocketry. But the aerospace concept's fundamental encouragement came not so much from the desire to reach space for its own sake. Rather, it arose from the airmen's desire to expand the capability of airpower—which, in the context of the midforties, meant strategic attack.

Airmen conceived the notion of strategic attack prior to World War II and bore it during the war's course on the wings of their machines. In the wake of airpower's success, winged strategic attack emerged from the war as the sine qua non of America's cold war defense force posture. However, because the capability to strike deep would garner the majority of postwar defense funding, while airmen were thinking about rockets, soldiers and sailors began building them.

The Air Force actually began active pursuit of rocket technology only after other services threatened to secure a portion of the Air Force's primary operational mission with their own rockets. Air Force interest in satellites began through a similar dynamic.

Interestingly, all of these events—as well as the emergence of the aerospace concept itself—took place prior to the Air Force gaining its independence in July 1947. Furthermore, these events established virtually every strand of horizontal and internal issues that will come to challenge the aerospace concept throughout the rest of this study. Consequently, understanding the period of 1944-47 is critical.

To develop this awareness, this chapter prepares the stage by briefly describing the geopolitical and national context of the times and discussing the preexisting conflict between the Army and the Air Force over the control of missile development. It then introduces the appearance of the aerospace concept and follows its development through mid-1947 amidst early interservice organizational challenges. However, because the operational foundation of the aerospace concept lies in the role of strategic attack and the intellectual underpinnings of this role are embodied in airpower theory, it is worthwhile to begin this discussion by briefly examining the theory's nature as it emerged from the Second World War.

Intellectual Underpinnings of the Aerospace Concept

American airpower theory approached World War II as a body of ideas cobbled together primarily from the thoughts of Giulio Douhet, William

"Billy" Mitchell, and the Air Corps Tactical School. Entering this war, proof of the theory's concepts was scant. The fight by Army Air Corps for acceptance of their ideas had been by this point based largely on faith. *In theory*, "strategic attack," enabled by the employment of airplanes, would be generally indefensible. "The bomber would always get through." *In theory*, airpower would thus be decisive in combat. Aerial bombardment of an enemy's war-making capability deep within its interior would bring a nation to its knees. *In theory*, airpower would change the very nature of warfare.

The experience of World War II found the airman's theory in need of refinement, but it certainly provided validity for its general claims. Although the tremendous losses that American and Allied airmen suffered during the war disputed advocates' claims of airpower's indefensibility, the effect of airpower on the war's outcome could not be denied. The *United States Strategic Bombing Survey* found sufficient cause to conclude that in the European theater, though "it might have been employed differently or better in some respects. . . . [airpower] was decisive."¹ Nor was there any question after 6 August 1945 that strategic attack, with atomic weapons delivered by airplanes, had changed the nature of war. That airpower's newly demonstrated capability would affect drastically the nature of the postwar "peace" was, however, not so evident.

Setting the Contextual Stage

In the eyes of Joseph Stalin, America's possession of the atom bomb had upset his forecast of the postwar geopolitical balance. Days following the nuclear detonations over Japan, Stalin summoned his commissar for munitions and his director for atomic research. "A single demand of you, comrades," said Stalin. "Provide us with atomic weapons in the shortest possible time. You know that Hiroshima has shaken the whole world. The equilibrium has been destroyed. Provide the bomb—it will remove a great danger from us."²

If it was not yet known in America that the Soviet Union was reenergizing its atomic weapons program, it was certainly evident that the postwar peace would be a tenuous one. The Soviets had maneuvered at Potsdam to secure a power base in Eastern Europe. Stalin's first major postwar address in February 1946 was received in the West as a declaration of ideological war on capitalism.³ Soon, the Soviets were sponsoring communist uprisings in Iran and Greece.

Across the Atlantic as the war drew to a close and during the two years that followed, America was settling into its new role as the Free World's leader with a wary eye on the emerging Soviet threat. But the nation's focus was also drawn inward toward dismantling its wartime economy and demobilizing 85 percent of a 2.4 million strong military.

Amidst this domestic upheaval, the outer reaches of military research and development (R&D) received little attention and, as such, tended to proceed largely unaffected by the massive drawdown. Specifically, the development of guided missile and rocket technology continued in the war's aftermath much the same as it had during the war, if perhaps at a less frantic pace. Furthermore, there was ample reason to leave it alone. With

strategic attack emerging as the military's postwar defense framework, both the Army and the Navy had an organizational interest in developing the potential of longer-range weapons. Because the Army had a long history with rocketry—Francis Scott Key wrote of the “rocket's red glare” over Fort McHenry in Baltimore Harbor during the War of 1812—it is not surprising then that one of the aerospace concept's earliest external challenges came from the Air Force's parent service. Organizational conflict over operational control of missiles arose prior to the war's end and nearly simultaneously with the earliest emergence of the airman's extended view of his medium.

Control of Missile Development

Prior to 1944 missile development in the Army had proceeded along two separate but comfortable paths. Air-breathing cruise missile programs were the Army Air Corps's responsibility. Rocket technology, long applied with projectiles as an artillery function, was Army Ordnance's. However, by 1944, as rocket technology began improving, the potential of its operational application began to encroach upon the airmen's strategic domain. The Army's research program responsible for these developments was called ORDCIT.

The acronym captured the relationship of the program's participants: Army Ordnance (ORD) and Dr. Theodor von Kármán's team of scientists and engineers from the California Institute of Technology (CIT). Dr. von Kármán's team had been experimenting independently with rockets since the late thirties. By 1943 Col W. H. Joiner—an Air Force liaison officer involved and impressed with the university's research—suggested that CIT should let the military know of its progress. Dr. von Kármán's team prepared a report concluding that with state-of-the-art technology, a 10,000-pound rocket could reach an altitude of 75 miles. On 20 November 1943, von Kármán forwarded the report to the War Department.⁴ For reasons unclear, the Air Force backed away from the project. ORD, however, did not; and in January 1944, they contracted von Kármán's team to begin research in White Sands, New Mexico. By the year's end, ORDCIT had fired an eight-foot, 500-pound missile 11 miles down range and was beginning to explore the effect of attaching lifting devices to improve its range and guidance characteristics. While ORDCIT's results hardly threatened airmen, the technology's potential clearly did.⁵

The encroaching capabilities and potential operational overlap of the Air Force's cruise missile and ORDCIT's rocket programs did not go unnoticed by either side. Debate over which forces should ultimately control missile development arose and, by the fall of 1944, had reached the highest levels of Army command. Army leadership determined that the developing technologies did not yet offer a clear indication of trends and chose to maintain a status quo R&D arrangement. Lt Gen Joseph T. McNarney, deputy chief of staff of the Army, issued the following policy in a memorandum dated 2 October 1944. The McNarney memo stated:

- a. That the Commanding General, Army Air Forces, have research and development responsibility, including designation of military characteristics, for all guided or homing missiles dropped or launched from aircraft.
- b. That the Commanding General, Army Air Forces, have research and development responsibility for all guided or homing missiles launched from the ground which depend for sustenance primarily on the lift of aerodynamic forces.
- c. That the Commanding General, Army Service Forces, have research and development responsibility for guided or homing missiles launched from the ground which depend for sustenance primarily on momentum of the missile.⁶

Essentially, "winged" cruise missiles looked and performed like aircraft and therefore remained the Air Force's responsibility, while wingless ballistic missiles remained with the Army.⁷ Unfortunately, the policy was based on the nature of the technology being pursued rather than its potential effect on the battlefield. It did little to quell the larger strategic attack turf battles that loomed ahead. In October 1944 there was only a slight degree of irony in the fact that an Air Force research liaison officer had initiated the CIT report that led to the Army's interest in rocketry. But the irony would grow in the coming months as rocket technology ventured farther outward and upward. Meanwhile, as the Army continued pursuing its rocket research, the commander of the Army Air Force—for entirely different motivations—was beginning to put a far-reaching vision into motion.

The Aerospace Concept's Beginnings

The earliest indications of the Air Force's aerospace concept appear to have emerged in September 1944, one month prior to McNarney's memo. Its origins are traced to the imagination and vision of Gen Henry H. "Hap" Arnold, who was thinking about the future of strategic attack (and the possibilities of space) even before World War II's end. General Arnold had become acquainted with Dr. von Kármán in 1936 while he was the commanding officer at March Field in California. The following private conversation allegedly took place in September 1944 in Arnold's staff car at the end of a runway at New York's La Guardia Airport. It is recounted in von Kármán's autobiography, *The Wind and Beyond*:

General Arnold wasted no time in coming to the point: "We have won this war, and I am no longer interested in it. I do not think we should spend time debating whether we obtained the victory by sheer power or by some qualitative superiority. Only one thing should concern us. What is the future of air power and aerial warfare? What is the bearing of the new inventions, such as jet propulsion, rockets, radar, and other electronic devices?"

I listened with fascination. . . . This was September 1944. The war was not over; in fact, the Germans were to launch the Battle of the Bulge in December. Yet Arnold was already casting his sights far beyond the war, and realizing, as he always had, that the technical genius which could help find answers for him was not cooped up in military or civilian bureaucracy but was to be found in universities and in the people at large.⁸

Two months later, Arnold followed through with this private meeting and sent Dr. von Kármán an official memorandum. "I believe the security of the United States of America," it began, "will continue to rest in part in developments instituted by our educational and professional scientists." The letter went on to outline a proposal to establish a scientific advisory group to examine long-range strategic planning issues so as to place the Air Force's "postwar and next-war research and development programs" on a "sound and continuing basis." Arnold tasked von Kármán and a group of his associates to develop a report that would outline a framework for programs to guarantee

the security of our nation and serve as a guide for the next 10-20 year period.

I presume methods of stopping aircraft power plants may soon be available to our enemies. Is it not now possible to determine if another totally different weapon will replace the airplane? Are manless remote-controlled radar or television assisted precision military rockets or multiple purpose seekers a possibility? Is atomic propulsion a thought for consideration in future warfare? . . . I am asking you and your associates to divorce yourselves from the present war in order to investigate all the possibilities and desirabilities for postwar and future war's development as respects the [Army Air Forces] AAF. Upon completion of your studies, please then give me a report or guide for recommended future AAF research and development programs.⁹

Arnold's memorandum offered America's leading rocket scientist an opportunity he couldn't refuse.

Dr. von Kármán left the Army's ORDCIT program at White Sands in December 1944 to become the Air Force's first scientific advisor and chair the Air Force Scientific Advisory Group (SAG). The first fruits of this group's effort would appear exactly one year later with the publication of *Toward New Horizons*.

Meanwhile, during the year that von Kármán's report was being prepared, General Arnold took three significant steps that would profoundly influence the Air Force's future in space. The first occurred in September 1945 when Douglas Aircraft approached Arnold with the proposal to organize a civilian R&D think tank specifically dedicated to support Air Force strategic planning efforts. Arnold endorsed the proposal and earmarked the funding with which to organize it the following year. From this arrangement, Project RAND would be born. General Arnold's second step was to establish a functional division on the Air Staff to oversee R&D from within the Air Force. On 5 December 1945, Arnold placed it under the responsibility of Maj Gen Curtis E. LeMay. With the third, Arnold arguably established his vision, formally introduced the aerospace concept, and staked the military's first organizational claim on space. On 12 November 1945 Arnold officially submitted his perspective on the Air Force's long-range future in a report to Secretary of War Robert P. Patterson.

In his "Third Report to the Secretary of War," General Arnold forecast the natural evolution of airpower:

The Strategic Theory, as applied to the United States (US) air warfare concept, postulates that air attack on internal enemy vitals can so deplete specific industrial and economic resources, and on occasion the will to resist, as to make continued resistance by the enemy impossible. . . .

The following principles should guide those who are responsible for planning and conducting strategic air warfare:

- a. Through a world-wide intelligence system, maintain constantly up-to-date information regarding all phases of the national life, economy, and philosophy of potential enemy states.
- b. Maintain an analysis, continuously being revised to meet new conditions, to show the importance of all industries and other potential enemies and to evaluate the relative importance of each of the units in each activity.
- c. To meet any emergency with the rapidity which survival in future wars will necessitate, prepare and maintain plans, in consonance with the latest information to provide for destruction of the decisive units of the key industries and other activities of each potential enemy nation. . . .

Strategic air warfare can be neither soundly planned nor efficiently executed without a continuous flow of detailed information of this kind. . . .

Today, our Army Air Forces are the recognized masters of strategic bombing. . . .

When improved anti-aircraft defenses make this impracticable, we should be ready with a weapon of the general type of the German V-2 rocket, having greatly improved range and precision, and launched from great distances. V-2 is ideally suited to deliver atomic explosives, because effective defense against it would prove extremely difficult.

If defenses which can cope even with such a 3,000-mile-per-hour projectile are developed, we must be ready to launch such projectiles nearer the target, to give them a shorter time of flight and make them harder to detect and destroy. We must be ready to launch them from unexpected directions. This can be done from true space ships, capable of operating outside the earth's atmosphere. The design of such a ship is all but practicable today; research will unquestionably bring it into being within the foreseeable future.¹⁰

His report showed remarkable foresight given the state of technology at the time. Arnold expressed the importance of missiles and satellites as a means of preventing future Pearl Harbor-like surprise attacks. Although convinced that the current state of technology supported manned aircraft, he nevertheless saw a pilotless force in the future and placed his support behind developing intercontinental ballistic missiles (ICBM).¹¹ Furthermore, Arnold recognized the need for sound and constantly updated intelligence to support the application of force from the "air." General Arnold's vision was founded upon and consistent with airpower theory. There is little doubt that at the end of 1945, in his mind, the vertical domain had no boundary.

On 15 December 1945, however, von Kármán presented Arnold with *Toward New Horizons*, the SAG's long-range strategy report that Arnold had tasked the prior year. *Toward New Horizons* only offered lukewarm support to General Arnold's predictions about ICBMs and satellites, both receiving mention only in passing. Dr. von Kármán and his colleagues saw the technological barriers these systems faced as not being overcome for at least a decade.¹² Instead, the report primarily focused on the future of jet propulsion systems. "The next ten years should be a period of systematic, vigorous development, devoted to the realization of the potentialities

of scientific progress, with the following goals: supersonic flight, pilot-less aircraft, all-weather flying, perfected navigation and communication, remote-controlled and automatic fighter and bomber forces, and aerial transportation of entire armies."¹³ Its main conclusions argued for the necessity of a powerful air force capable of "reaching remote targets swiftly and hitting them with great destructive power, securing air superiority over any region of the globe, landing, in a short time, powerful forces, men and firepower, at any point on the globe, and defending our own territory and bases in the most efficient way."¹⁴

Toward New Horizons was decidedly "aircentric." It was a landmark document in that it established the critical relationship between technology and the Air Force's long-range planning efforts, a relationship that would invariably prove significant in the coming decade. While also fully consistent with airpower theory, it was, however, a subset within Arnold's broader scheme. Dr. von Kármán's primary focus was on air-breathing jet propulsion systems; and it inevitably worked to delay ballistic missile development within the service, which—by extension—slowed the Air Force's move into space.¹⁵ At a conceptual level, tension would emerge within the Air Force in the coming years between Arnold's broader vision, which fully included space, and von Kármán's more conservative atmospheric projection. But if it is interesting that Arnold's association with a rocket scientist ironically would prove to temper the Air Force's internal pursuit of space, then it is even more interesting to consider the influence of the rocket scientist, a "von" as well, who replaced von Kármán at ORDCIT.

Early Interservice Challenges

When the spoils of victory brought Dr. Wernher von Braun to America in September 1945, the Air Force was the only service thinking about space at the senior leadership level. ORD, on the other hand, was launching progressively larger rockets in the deserts of New Mexico. Soon, because of his influence, both the Army and the Navy would be seriously eyeing space as well.

Dr. von Braun played a leading role in Germany's rocket program, and the extent to which the Germans had developed rocket technology made him a prize catch in World War II's aftermath. Husbanded out of Germany in a secret intelligence operation known as Paperclip, von Braun, 120 of his colleagues, and 300 boxcar loads of V-2 components arrived at Fort Bliss, Texas, in September 1945. They were just in time to witness a test launch of ORDCIT's most ambitious missile test thus far. On 26 September the Army's WAC Corporal reached an altitude of 42 miles.¹⁶

In von Braun, with his accompanying complement of scientists, engineers, plans, and parts, the Army now had the world's most advanced rocketry research team. The Germans meshed perfectly with the Army's ambition to develop a long-range strategic artillery capability. But von Braun also brought with him a long-harbored interest in space that the Nazi regime had squelched in their more pressing need to develop the vengeance weapon. Thus, in the Army, von Braun had refuge where he could refocus on his lifelong dream, which—perhaps more than his rock-

etry genius alone—would have the most influence on the Army's budding missile program.

By the spring of 1946, ORDCIT, now redesignated Project Hermes, had reconstructed its first V-2 from the parts recovered in Operation Paperclip. On 16 April they successfully launched their first rebuilt German rocket. The event made the headlines of the *New York Times*—a public relations coup for the Army that did not go unnoticed by those in the Air Force. Both sides recognized the importance of public support in the emerging debate over unification of the armed services.¹⁷ Airmen were staking their independence on the strategic attack mission. The Army's ballistic missiles were beginning to challenge that mission. Holding "what was essentially the single-minded belief that guided missiles, no matter what their range, were really long-range artillery. . . [and] therefore an obvious Army weapon"; however, they were beginning to challenge the mariner's mission as well.¹⁸

The Navy's role was to control the high seas. Naval leadership—attuned to the emerging possibilities of rocketry to extend the reach of their fleets, as well as the Army's organizational maneuvering with the Germans and Project Hermes—decided to enter the missile melee. The chief of naval operations (CNO) established a guided missile section within the Navy Department with a straightforward mandate: "To develop guided missiles for use in war."¹⁹ Despite this mandate the early beginnings of naval rocketry were focused purely on research and, with the war's end, their missile program took on a decidedly civilian character.

Naval guided missile development had fallen to the Naval Research Laboratory (NRL). But as the war drew to a close, NRL's workforce—largely a collection of civilian scientists and physicists—welcomed the opportunity to focus again on basic research. One among them was Dr. Milton W. Rosen who had reviewed the classified debrief papers on the German V-2 program.

In the fall of 1945, Rosen approached his section chief with a proposal to use rockets to study the properties of the upper atmosphere. Rosen sold the idea to his research team; and in December 1945, NRL established the Rocket Sonde Research Branch for the clearly stated purpose of doing exactly that.²⁰ The following month, responding to an Army invitation for government agencies and universities to participate in high-altitude experiments with their program at White Sands, NRL's rocket team relocated to New Mexico and established the beginnings of what would in short time evolve into the Viking missile program.²¹ The program's civilian character also would be important in the years to come. But by mid-1945, von Braun's influence was taking the Navy beyond mere missilery.

Cmdr Harvey Hall, of the Navy's Bureau of Aeronautics Electronics Division, also found himself captivated by the German's work. Inspired by a provocative space study written by von Braun during his debriefing period in May 1945, Hall assembled a team to examine the feasibility of von Braun's concept of an artificial satellite.²² By late 1945, the Committee for Evaluating the Possibility of Space Rocketry produced a report concluding that an orbiting satellite was technologically feasible. Such a system had the obvious potential to bring far-reaching communications and reconnaissance capability to naval ships operating on the high seas. Estimating, however, that the satellite design work alone would cost between \$5

million and \$8 million, Hall's team was unable to garner full funding support from within the Navy for the project.²³ By January 1946, Hall was turning to the other services for support. He would propose the plan as an interservice venture at the War Department's Aeronautical Board meeting in March, which met every two months to coordinate aeronautical pursuits between the services.

By the end of 1945, with World War II not even five months over, all three services had elements within them that were eyeing the heavens—if for different reasons. The Army, as an organization, was still focused on rocketry for artillery purposes; but von Braun was in place and would exert a strong bent towards space in the future. R&D elements within the Navy saw potential in space to support its mission of sea control, but the service as a whole had not yet come to embrace the idea. The Air Force at this point was only involved in aerodynamic cruise missiles; but, organizationally, it was looking more ambitiously into space than the other two services. Arnold had indeed made an impact. The coming year would make this clear.

1946—The Year for Aerospace

The year 1946 would witness the heralding of the Air Force's aerospace concept that had first emerged with the vision of General Arnold in the fall of 1944. During this year, the Air Force's organizational strategy to secure the means for space developed, taking on the ballistic missile challenge posed by the Army as well as the satellite plans of the Navy.

On the second day of the year, a revealing memorandum appears from Col T. A. Sims of the newly formed R&D Division (of which Arnold placed LeMay in charge). It was addressed to Gen Ira C. Eaker, the Air Force's deputy commander. The memorandum questioned the ambiguity of the McNarney policy from October 1944 and recommended that the guided missile question be addressed at the next Air Staff meeting. Colonel Sims reasoned to the second highest-ranking officer in the Air Force:

There is no one agency within the War Department that has been assigned the responsibility for the development of guided missiles. . . . Many Ordnance developments encroach on the AAF field, for if controlled fins are placed on a [ballistic] missile to guide its path, it then becomes an aerodynamic problem. . . .

The [issue] is whether we should continue as is for the time being, . . . or whether we should attempt to energize our guided missiles program and take over some of the projects started by Ordnance. . . .

. . . would it not be wise at this time to include as part of our 70-group Peace time Air Force [sic] and also in our mobilized Air Force a certain number of strategic missile groups. Admittedly, we do not know the composition of a guided missile launching force, however, we could show these without a troop basis at this time, just to indicate progressive thinking and the AAF interest in taking a major part in the lightning warfare of the future. If we do not do this the Artillery may beat us to the punch.²⁴

In January 1946, the Air Force had a hand in cruise missiles; but there was nothing remotely resembling a strategic ballistic missile program, let alone plans for an operational force.

Meanwhile, the Navy's satellite proposal made the War Department's 7 March Aeronautical Board agenda. Amidst noticeable interest, the board agreed to discuss the idea further when it reconvened on 14 May.²⁵ The Navy's proposal, and the two-month intermission that followed, had a profound effect within the Air Force.

The Aeronautical Board's Air Force members brought the proposal back to their boss, General LeMay. The deputy chief of staff for R&D in turn went directly to Gen Carl A. Spaatz, who had replaced Arnold as the Army Air Forces commanding general on 1 March. Significantly, LeMay also brought a piece of relevant personal experience to this meeting. In August 1937 LeMay had participated in an Air Corps sea search mission whereby B-17s located, photographed, and bombed the battleship *Utah* to prove that the Air Corps, not the Navy, could better provide for long-range sea reconnaissance.²⁶ Now, nine years later and for the first time, Army Air Force leaders fashioned their rationale for an Air Force space mission: "military satellites represented an extension of strategic airpower"; and, therefore, the Air Force should have primary responsibility for any military satellite vehicle. William Burrows, in *This New Ocean*, points out that "this was most likely the first time that [the Air Force confronted the other services and] claimed space as a continuation of their traditional operational environment."²⁷ Lacking any detailed studies to set against the Navy's, however, LeMay tapped into the funds Arnold had set aside for just such a project and tasked RAND to open its operations.²⁸

Pulling together 50 of Douglas's best scientists and engineers, the newly formed think tank took just three weeks to produce their 321-page report.²⁹ In what is arguably their most monumental study ever written, RAND's *Preliminary Design of an Experimental World-Circling Spaceship* offered the first comprehensive analysis of the potential military uses of satellites. As opposed to von Kármán's assessment delivered just five months prior, which put the development of a satellite more than 10 years away, RAND's report predicted that at a cost of \$150 million the United States could launch a 500-pound payload into a 300-mile-high orbit *within five years*. It supported this claim with detailed technical feasibility studies backed by even their most conservative engineers. The study also detailed a number of potential uses that included communications, observation, weather, and weapon impact spotting, but ruled out its early use as an atomic weapon due to the weight of atomic warheads at the time.³⁰ However, its most oft quoted passage carried the satellite's potential still further. "In making the decision as to whether or not to undertake construction of such a craft now, it is not inappropriate to view our present situation as similar to that in airplanes prior to the flight of the Wright brothers. We can see no more clearly all the utility and implications of spaceships than the Wright brothers could see fleets of B-29s bombing Japan and air transports circling the globe."³¹ The analogy here was clear. While early on the satellite might only be capable of passing radio communications or taking pictures, future technological advances no doubt held great promise for its use as a weapon system.

On 14 May, armed with RAND's epic report and standing on the notion that satellites represented an extension of strategic airpower, LeMay formally rejected the Navy's proposal for an interservice space program. The move to claim Air Force responsibility for military satellites reaffirmed Arnold's earlier claim on space operations in general.

During the month that RAND put together its report, the Air Force also made its first move into the rocket-propelled missile business. In April the Air Force awarded a contract to Consolidated Vultee (soon to become Convair and later General Dynamics) to study the development of a long-range ballistic missile. From this study the Atlas program would later emerge.

By early fall Air Force thinking on the missile control question was clearing even more. The following memo from General LeMay to General Spaatz appeared on 20 September 1946 and showed the Air Force's developing position on strategic missiles:

At the outset it was recognized that Ordnance was entering the field early and aggressively to antedate AAF competition, so that the 2 October 1944 directive was proposed and written by the AAF with intent to eliminate destructive competition, and to limit the Ordnance Department to non-aerodynamic missiles. . . .

One very serious reason for not giving ground is the stated opinion of Army Ground Forces that AGF should operate its own guided missiles, close support aircraft, and strategic bombardment aircraft, classing all these as extensions of artillery. It is fairly certain that if development of missiles is turned over to Ordnance, operation will be done by Army Ground Forces, and it will be only a short and logical step from this to operation of support and strategic aircraft by AGF. . . .

Our best course seems to be to . . . [request] for assignment of all guided missiles, driving at economy and clear, workable directives, making it plain that our ultimate aim is to better prepare the U.S. for the war which is sure to come. . . .

The long-range future of the AAF lies in the field of guided missiles. Atomic propulsion may not be usable in manned aircraft in the near future, nor can accurate placement of atomic warheads be done without sacrifice of the crews. In acceleration, temperature, endurance, multiplicity of functions, courage, and many other pilot requirements, we are reaching human limits. Machines have greater endurance, will stand more severe ambient conditions, will perform more functions accurately, will dive into targets without hesitation. The AAF *must* go to guided missiles for the initial heavy casualty phases of future wars.³²

LeMay's 1946 position on ballistic missiles would remain relatively unchanged in his role, throughout the coming decade, as the primary architect and leader of Strategic Air Command (SAC).

Of the aerospace events that occurred within the Air Force in 1946, the diamond in the rough was RAND's groundbreaking report. However, it was so not for its obvious long-term visionary value but rather because the report explicitly recognized that missile and satellite development intimately complement one another. "There is little difference in design and performance between an intercontinental rocket missile and a satellite . . . Consequently, the development of a satellite will be directly applicable to the development of an intercontinental missile."³³ Unfortunately, it would take the Air Force another nine years to recognize this relationship. In the interim, Air Force missile advocates would tend to see the satellite as a resource competitor.

By mid-1947, there is clear evidence that General Arnold's vision was beginning to take hold within the organization. Furthermore, airmen drew no notice, within the intellectual framework of their theory and amidst the emerging technological capabilities potentially enabling the vertical domain to extend beyond the atmosphere, that space was a different realm. It is equally significant, however, that these positions developed primarily because of challenges from other services encroaching upon what the Air Force saw as its turf.

In sum, the aerospace concept appeared in the form of General Arnold's far-reaching vision and was able to develop between 1944 and 1947 because the top-down contextual environment, emerging technologies, and the concept's intellectual foundation all supported it to do so. Horizontal challenges from the Army and the Navy only encouraged its growth. The concept continued to be pulled along because Arnold was successful in passing his vision on to key follow-on leaders within the Air Force.

Such was the state of development of the airman's view of the vertical as the Air Force approached its independence. But if in 1946 the aerospace concept appeared to be on the verge of coming in like a lion, during the remaining years of the Truman presidency, one would be hard-pressed to argue that it might not go out like a lamb. Fiscal realities, the perceived immediacy of the growing Soviet threat, and the challenge of reorganizing while fulfilling the needs of the nation's defense would pull the Air Force's focus inward toward more immediate issues and send the concept into all but hibernation.

Notes

1. *United States Strategic Bombing Survey: European War, Pacific War*, Summary Report, 30 September 1945 (1945; reprint, Maxwell Air Force Base [AFB], Ala.: Air University Press, 1987), 37.

2. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (1985; reprint, Baltimore: Johns Hopkins University Press, 1997), 49. Quote from A. Lavrent'yeva in *Stroiteli novogo mira*, *V mire knig* (1970), no. 9, 4, cited by David Holloway, *Entering the Nuclear Arms Race: The Soviet Decision to Build the Atomic Bomb* (Washington, D.C.: Wilson Center, 1979), 41.

3. John Lewis Gaddis, *We Now Know: Rethinking Cold War History* (New York: Clarendon Press, 1997), 23.

4. Theodor von Kármán and Lee Edson, *The Wind and Beyond: Theodor von Kármán, Pioneer in Aviation and Pathfinder in Space* (Boston: Little, Brown & Co., 1967), 264-65. In this memoir, incidentally, von Kármán forwards the belief that this document was the first official document in the US missile program.

5. Von Kármán and Edson, 265; Michael H. Gorn, *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986* (Washington, D.C.: Office of Air Force History, 1988), 16; and Maj Gen John B. Medaris, US Army, Retired, *Countdown for Decision* (New York: G. P. Putnam's Sons, 1960), 52-53.

6. Joseph T. McNarney, deputy chief of staff, memorandum to the Commanding General, Army Air Forces, 2 October 1944, as cited in Edmund Beard, *Developing the ICBM: A Study in Bureaucratic Politics* (New York: Columbia University Press, 1966), 22; and McDougall, 84.

7. Kenneth P. Werrell, *The Evolution of the Cruise Missile* (Maxwell AFB, Ala.: Air University Press, 1985), 80.

8. Von Kármán and Edson, 267-68.

9. Cited from a memorandum dated 7 November 1944 from Gen Arnold to Dr. von Kármán, in Theodor von Kármán, *Toward New Horizons*, vol. 1, "Science, the Key to Air Supremacy," a report to the commanding general of the Army H. H. Arnold by the Army Air Force Scientific Advisory Group, 15 December 1945, iii-v.
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11. David N. Spires et al., *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, Colo.: Air Force Space Command, 1997), 9-10.
12. *Ibid.*, 11.
13. Von Kármán, ix.
14. *Ibid.*, 4.
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16. Medaris, 53.
17. Beard, 34-36; and Roger D. Luanus, "Prelude to the Space Age," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1, *Organizing for Exploration*, ed. John M. Logsdon (Washington, D.C.: National Aeronautics and Space Administration [NASA] History Office, 1995), 14.
18. William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998), 125.
19. *Ibid.*, 124.
20. Milton W. Rosen, *The Viking Rocket Story* (New York: Harper & Brothers, 1955), 20.
21. *Ibid.*, 22.
22. Burrows, 118.
23. R. Cargill Hall, "Earth Satellites, A First Look by the United States Navy," in *Essays on the History of Rocketry and Astronautics: Proceedings of the Third Through the Sixth History Symposia of the International Academy of Astronautics*, vol. 2, ed. R. Cargill Hall (Washington, D.C.: NASA Scientific and Technical Information Office, 1977), 258.
24. Memorandum from Colonel Sims to General Eaker, 2 January 1946, file 145.86-19, subject: Guided Missiles, Air Force Historical Research Agency, Maxwell AFB, Ala. Memorandum is also cited in Beard, 33.
25. Burrows, 124-25; and Spires, 14.
26. Burrows, 125.
27. *Ibid.*, 127.
28. Spires, 14.
29. Robert L. Perry, *Origins of the USAF Space Program, 1945-1956*, Air Force Systems Command (AFSC) Historical Publications Series 62-24-10 (Los Angeles: AFSC, Space Systems Division, 1961), 12.
30. The RAND report summary's major points were drawn largely from Spires's discussion in *Beyond Horizons*, 15-16.
31. RAND, *Preliminary Design of an Experimental World-Circling Spaceship*, Douglas Aircraft Co., Inc., Santa Monica Plant Engineering Division, Report Number SM-11827, Contract Number W33-038 AC-15105, 2 May 1946, 1.
32. Gen Curtis E. LeMay, DCAS, R&D, memorandum to Gen Carl A. Spaatz, 20 September 1946, file "AAF, GM Policy, 1946," Box "A-7 Catapults," Headquarters USAF, DCS/D, GM Branch, National Archives, as cited in Beard, 37-39; McDougall, 90; and Spires, 18-19.
33. RAND, *Preliminary Design of an Experimental World-Circling Spaceship*, 10.

Chapter 3

Aerospace versus the Air Force (1947-52)

From Stettin in the Baltic to the Trieste in the Adriatic, an iron curtain has descended across the Continent.

—Winston Churchill

Beginning roughly in July 1947, the aerospace concept fell upon hard times, stagnating—and at times perhaps even receding—for the better part of the next six years. Many different contextual factors contributed to its lack of development. The nation's chosen security strategy against the emerging Soviet threat, a waning domestic economy, and interservice battles over roles and missions—all played a part in hindering the concept's further development. But issues internal to the Air Force contributed far more to the concept's stall than external factors. For the first three years of Air Force independence, leadership focus fell upon near-term problems as the Air Force struggled to build its strategic force in being. Consequently, the momentum the aerospace concept carried into this period all but disappeared. In 1950 signs emerged of a gradual upswing as funding was released to shore up defense. Finally, toward the end of Truman's presidency, thermonuclear testing success provided a needed boost to the concept as it entered the 1950s.

This chapter presents these issues and their corresponding effect on the aerospace concept in an organization similar to the previous chapter. First, the top-down context is established by describing the geopolitical environment and the emergence of a national strategy to counter it. The discussion then digs deeper into interservice issues that arise as a result of this context. Finally, it hones in on internal issues within the Air Force to present a clearer picture of the factors that contributed to the aerospace concept's struggle during this period. Where the chapter differs from the previous one is in its level of focus. Having established a detailed understanding of the concept's roots, the discussion now begins to broaden its scope.

The Cold War and Economic Reality

The emergence of the cold war generally characterizes the geopolitical context from mid-1947 through the end of Truman's time in office. By June 1947, partly in response to Soviet influence expanding into Eastern Europe and partly in recognition that America's long-term interest was ultimately tied to a healthy West European economy, Congress enacted the Marshall Plan to accelerate Europe's recovery from World War II. Within three months the Soviets countered by establishing an economic block in

the east. Foreshadowing the evolving nature of this ideological conflict, an economic curtain fell across the middle of Europe. The following summer Russia blockaded Berlin and, for a year, put to test the West's resolve. In Berlin's aftermath democratic Europe's collective efforts moved beyond economics and into defense, taking shape around the formation of the North Atlantic Treaty Organization. These first two years of cold war concentrated themselves in Europe. During the remainder of Truman's last term, the cold war went global.

In 1949 Communism triumphed in China, and the Soviet Union successfully tested an atomic bomb. With nuclear parity among the superpowers now clearly on the horizon, the Soviet threat suddenly seemed more immediate. In the minds of most Americans, this suspicion was confirmed in June 1950 as the North Koreans invaded southward.

Within this evolving geopolitical context, a national security debate emerged that established the intellectual foundation for America's cold war strategy. Because the outcome of this debate would drive the character and makeup of America's postwar military, it is of value for a moment to examine its nature.

Walter McDougall, in *The Heavens and the Earth*, characterized the debate as one that sought to understand "the nature of the (Soviet) beast" and described it as framed by the ideas of George Kennan and Paul Nitze.¹ Kennan argued in July 1947 that "the main element of any US policy toward the Soviet Union must be that of a long-term, patient but firm and vigilant *containment* of Russian expansive tendencies."² Noticeably ambiguous in Kennan's argument, however, was the undefined meaning of long-term. Consequently, America's hawks were unconvinced.

Nitze held a tougher line that he eventually submitted in a March 1950 report to the secretary of state. Nitze's report "recommended a 'rapid and sustained build-up of the political, economic, and military strength of the free world . . . ' Only the United States had the wherewithal to balance the power of an adversary that, unlike previous expansionist powers, was 'animated by a new fanatic faith, antithetical to our own, and seeks to impose its absolute authority over the rest of the world.'"³

Kennan's containment argument fell upon receptive ears amidst a time of uncertainty. Not only was it more cautious in the fog of an emerging cold war but it was also cheaper to execute. In 1947 America was also struggling through a postwar recession. Given the strains on its economy, containment was the strategy of choice through the late forties. While Nitze's position would eventually give containment its teeth, it wasn't until after North Korea invaded in June 1950 that America would find reason to substantially reinvest in its military.

The national strategy debate naturally shaped America's postwar defense posture decisions. The need for fiscal restraint was imposing severe limits on defense spending. In the wake of the 25 July 1947 National Security Act, both the Truman administration and the Republican-held Congress began the task of finding an economically feasible force structure with which to "contain" Soviet power. Strategic airpower, in the form of a nuclear capable "air force in being," would be the answer.

After six months of hearings, in January 1948 the Finletter Report put forth the administration's position. Finletter's Commission, named after

its chairman, former State Department attorney Thomas K. Finletter, recommended the United States maintain "an adequate Navy and Ground Force . . . built around the air arm . . . Our military security must be based on air power . . . What we must have and can support is a reasonably strong defensive establishment to minimize the enemy's blow, but above all a counteroffensive *air force in being* which will be so powerful that if an aggressor does attack, we will be able to retaliate with the utmost violence and to seize and hold the advanced positions from which we can divert the destruction from our homeland to his."⁴

Two months later, Congress released the findings of its Brewster Board, a joint bipartisan study conducted under the chairmanship of Maine senator R. Owen Brewster. Surprisingly, there was little disagreement. While the congressional report was somewhat critical of Truman's position for its general lack of detail, it also agreed that the best deterrent against Soviet expansion was strategic airpower. The unison went further still. Both recognized the requirement to spend the money to develop and reach the target of a 70-group strong strategic Air Force by 1953.⁵ Former Secretary of War Patterson's official testimony from the previous fall summed up the consensus within the American government: ". . . we will not need the strongest Army in the world or the strongest standing Navy in the world, but we will need the strongest Air Force in the world."⁶

The three military services received the resolution of the late forties force structure debate differently. For the Army and Navy, there was natural cause for deep concern. It was clear, in the period of austere budgets, that the nature of the force structure arguments meant the tax for building the nation's strategic airpower capability would likely be extracted from within the defense budget. Indeed, according to the Brewster Report's projections, the monetary requirements to reach a 70-group strategic air force by 1953 meant that airmen would be receiving about one-sixth of the total national budget. Given Truman's forecast defense spending plans, the Air Force would require more than one-half of the projected defense dollars.⁷ To airmen, however, these projections were naturally welcome news, solidifying the efficacy of airpower during the crucial period of their emergence as an independent force. Thus interservice rivalry for money was intense, and it expressed itself in terms of roles and missions.

The Key West Agreement

The National Security Act of 1947 established the division of the three services around land, sea, and air forces, but it did little to address the nuts and bolts of each service's responsibilities. In an attempt to resolve these critical unanswered questions, the nation's first secretary of defense, James Forrestal, called the service chiefs together on 11 March 1948 for four days of historic deliberation. Named after the location where these discussions took place, the Key West Agreement was signed by the president on 21 April and established a foundation for the services' functional responsibilities.

Of interest in this agreement, with respect to this study's focus, were three somewhat innocuous omissions. First, the guided missiles controversy, now four years in existence between the Army and the Air Force, was nowhere addressed. The joint chiefs agreed that strategic air warfare was the functional responsibility of the Air Force. The Navy was able to keep a strategic attack foot in the door by retaining the ability "to conduct air operations as necessary for the accomplishment of objectives" consistent with their primary function of gaining and maintaining general sea supremacy.⁸ Nothing, however, was mentioned of the Army's role in long-range warfare.

Second was an interesting omission concerning the service-assigned reconnaissance responsibilities. Key West gave the Navy primary responsibility "for *naval* reconnaissance . . . including the air aspects thereof." The Air Force's only mentioned reconnaissance mission was imbedded in its primary function "to furnish close combat and logistical air support to the Army, to include . . . aerial photography, [and] *tactical* air reconnaissance."⁹ The role of *strategic* reconnaissance appeared nowhere in the document. Finally, the Key West Agreement never mentioned the word *space*.

The latter omission is explainable simply from the fact that as of spring 1948, America possessed nothing remotely close to an operational space capability. All three services clearly saw evidence that this capability was near, but to expect the topic of space to arise in a four-day deliberation on more pressing issues was unrealistic. The second omission concerning strategic reconnaissance, however, is not so easy to explain.

In March 1946 the conflict over strategic reconnaissance had surfaced with the Navy's proposal for an interservice satellite program. The Air Force's response was clear—the reconnaissance capability of satellites represented an extension of strategic airpower. Conflict between the two services had flared again "in December 1947, when the Navy formally submitted to the Department of Defense (DOD) Research and Development Board a claim for exclusive possession of rights to satellite development."¹⁰ This move by the Navy prompted the following Air Force policy statement from Deputy Chief of Staff Hoyt S. Vandenberg on 15 January 1948, just two months prior to the service chiefs' conference in Key West:

The USAF, as the service dealing primarily with air weapons—especially strategic—has the logical responsibility for the satellite. Research and Development will be pursued as rapidly as progress in the guided missiles art justifies and requirements dictate. To this end, the program will be continually studied with a view to keeping an optimum design abreast of the art, to determine the military worth of the vehicle—considering its utility and probable cost—to insure development in critical components, if indicated, and to recommend initiation of the development phases of the project at the proper time.¹¹

The Navy withdrew its claim on satellites the following day.¹²

It is difficult to determine the motives behind a decision not to mention something. One can surmise, however, that the Navy may have seen its responsibility for naval reconnaissance as extending logically into satellites just as likely as the Air Force saw its satellite claim as an extension of its responsibility to conduct strategic aerial warfare. Either perspective, the Navy's or the Air Force's, would have had nothing to gain by raising

the issue at the Key West bargaining table. Because General Spaatz—who together with LeMay in 1946 developed the Air Force position on satellites—was in Key West holding the Air Force position, one can only wonder what might have gone on—or did not—in his mind concerning this issue. Over the next 12 years, in subsequent amendments to the Key West Agreement, the issue would never arise. Instead, the role of strategic reconnaissance eventually would fall to an entirely different organization. Alternatively, the issue surrounding guided missiles subsequently received much attention following the initial Key West Agreement.

The question of guided missile control may have been left out intentionally. Certainly, the interservice discussions of the previous four years, beginning with the McNarney memorandum of October 1944, had not resolved the issue. It would take six additional changes to the agreement over the next eight years, all approved by the secretary of defense, before an agreed-upon solution would finally take shape. In the interim the Army continued to extend the range of its artillery.

Interservice Developments

The Army's rocket program was able to garner enough support to continue through the lean resource years of the late forties. The ORDCIT/Project Hermes team had made national headlines in the spring of 1946 with their publicized launch of the first "American made" V-2. Testing and refinements in the three-year interim had brought their rocket capabilities along to a point where they were once again ready to make a significant mark on history. On 24 February 1949, von Braun and company fired a V-2-modified WAC Corporal 244 miles into the sky. Their rocket became the first man-made object ever to enter space.¹³ While the altitude attained was considered by many to be a remarkable achievement, to others 244 miles "up" easily translated to some similarly long distance "out."

Five months earlier, in September 1948, DOD had circulated a policy that worked to frame the missile control issue for the first time in terms of operational, rather than technological, characteristics. Though never articulating a distance, the policy declared that the Army would be responsible for tactical missiles while the Air Force assumed the same for strategic missiles.¹⁴ Nine months following the historic WAC Corporal launch, the Key West Agreement received its first two secretary of defense approved amendments concerning guided missiles. The first appeared on 17 November 1949. Addressing short-range surface-to-surface systems, it stated that "guided missiles which supplement, extend the capabilities of, or replace the fire of artillery will be the responsibility of the U.S. Army and the U.S. Navy as required by their functions." Five months later a second amendment followed further clarifying that "surface-launched guided missiles which supplement, extend the capabilities of, or replace Air Force aircraft will be the responsibility of the U.S. Air Force."¹⁵ Still, enough ambiguity remained so that Army Ordnance continued its work undeterred.

In April 1950, having expended the last of their V-2 stock, Project Hermes closed its doors at White Sands once and for all. Dr. von Braun and

his team relocated to Redstone Arsenal in Huntsville, Alabama, and helped activate the Army Ordnance Guided Missile Center. By the end of Truman's term in office, the Redstone missile was approaching the capability of sending a small warhead 500 miles downrange.¹⁶

The Navy's recourse to the top-down contextual elements present in the late forties took on somewhat of a different character. The Navy, however, had a fundamentally different problem. While the Army, as the nation's land force component, could feel relatively secure in its most basic mission, the Navy's Mahanian blue water force found itself in the post-World War II environment wont of a comparable enemy. The great navies of the world that posed any threat to America had been soundly disposed of in the war. The Soviet Union was still far from posing a challenge to American naval supremacy on the high seas. The findings of the Finletter Report only confirmed this reality. Consequently, the Navy's strategy to acquire a relevant mission took on a more immediate character.

With the established role for naval airpower that emerged from their experience in the Pacific campaign of World War II now legitimized in the Key West Agreement, the Navy sought to extend its maritime reach with the supercarrier concept. A 65,000-ton aircraft carrier that could support heavy bomber operations was a logical and intellectually supportable concept from a perspective of sea power theory. Despite the Air Force's established and reaffirmed ownership of strategic attack, Secretary Forrestal supported the concept. In his diary he noted, "I was against the development of a new fleet of supercarriers by the Navy but I felt it was most important that one such ship, capable of carrying the weight of a long-range bombing plane, go forward."¹⁷

Ultimately, the USS *United States* never sailed. With a projected price tag of \$188 million, it was economically unsupportable given the budget-austere environment that existed. After conferring with Generals Bradley, Vandenberg, and Eisenhower—and finally President Truman—on 23 April 1949, Defense Secretary Louis A. Johnson, Forrestal's replacement, issued orders to terminate its construction.¹⁸ However, the interservice threat to the Air Force's role of strategic attack posed by the supercarrier during its two-year life span represented a fundamental challenge to airmen and resulted in a major countereffort to defend the development of its B-36 strategic bomber as a more economical and viable alternative.

Amidst this larger and more immediate battle between sailors and airmen, the Navy's two unimposing space-related programs quietly took divergent paths. After failing to win interservice support in May 1946 for its satellite proposal, and backing away from an independent claim on satellites in January 1948, the Navy's satellite program languished in a funding drought before getting officially shelved toward the end of the year.¹⁹

NRL's Viking missile program, however, managed to survive. Still focusing on basic exoatmospheric research in its three-year effort thus far, the primarily civilian Viking program developed the first all-aluminum structure, pioneered a gimbaled motor for thrust vector control, and successfully launched their first rocket, the Viking 1, at White Sands on 3 May 1949. By January 1953, eight additional rockets had been fired, the highest—Viking 7—reaching an altitude of 136 miles.²⁰

Aerospace Lost

Within the Air Force the aerospace concept suffered considerably in the three years following the service's independence. The concept's development, especially at this early stage in its life, was extremely dependent upon the focus of Air Force leadership. Besides the significant external top-down and horizontal contextual pressures that were drawing attention to more immediate issues confronting the fledgling service, there were pressing problems within the service as well.

Immediately before it lay the task of building an operationally ready strategic attack force to meet America's defense requirement. At the end of 1946, the nation's atomic stockpile totaled nine unassembled bombs. By the time the Air Force achieved its independence, this figure had risen to 13.²¹ Furthermore, five months into its existence the Air Force possessed only two qualified weapon assembly teams; and it was "estimated that, once a bomb was ferried to a combat base, it would take sixty hours to have it loaded in a B-29 and ready to go."²² Complicating the strategic attack force issue were the developmental requirements of the aerial refueling and fighter escort force necessary to support it.

For a new service, facing this sort of challenge and operating on a budget designed only to develop a nuclear capable, 70-group force in being by 1953, the technological push element of the aerospace concept naturally took a beating. Prior to its independence, the Air Force's R&D budget for missile development saw a dramatic increase from 1945 to 1946, jumping from \$3.7 million to \$28.8 million in support of 26 different programs. For fiscal year (FY) 1947, the service projected an additional increase to \$75.7 million. "Instead, the President's austerity plan cut back missile R&D to \$22 million. Eleven programs died at once."²³ The programs that survived were those expected to become available the soonest—the Air Force's air-breathing cruise missiles. Because ballistic missiles did not appear to have any promise for the next eight to 10 years, Convair's contract for a long-range ICBM, awarded just 15 months earlier, was among the first to go.²⁴ In July 1947 the Air Force's only ballistic missile program was cancelled.

Satellite stock suffered in the crunch as well. In December 1947 Air Materiel Command (AMC) reviewed the accumulating number of RAND papers and issued a report that affirmed the technical feasibility of the reconnaissance satellite but questioned both its military utility and the high cost of building one. "Constrained by 'scarce funds and limited component scientific talent,' [the report concluded that] the Air Force should not risk supporting a satellite development program when guided missiles deserved research funding priority."²⁵ The position was certainly supportable given the fact that at its core, the Air Force was a strategic attack force. Furthermore, the satellite was a terribly expensive system to perform a role that aircraft were presently capable of performing. While satellites continued to hold a back seat to all other aerospace related R&D projects in the Air Force, AMC's report recommended that RAND's conceptual research should continue.

Given the satellite's low priority in the Air Force's schema of the time, the decision to support further studies at RAND was a rather insignifi-

cant, albeit encouraging, sign in support of the aerospace concept. The benefit of historical hindsight, however, offers an alternative perspective. Sufficiently armed with the technological confidence that a satellite was realistically feasible, RAND analysts began to build a stronger argument for why it should be pursued. Over the next three years, the think tank produced a series of papers that culled the satellite's prospective utility. A RAND interim summary conference in 1949 shed light on the character of the developing argument. Emphasizing the passive satellite roles of communications and reconnaissance, RAND argued that a satellite could serve a major element of political strategy as an intelligence provider. The conferees concluded "no other weapon or technique known today offers comparable promise as an instrument for influencing Soviet political behavior."²⁶ RAND's argument reached its full maturity the following year with the publication on 4 October 1950 of RM-567, "The Satellite Rocket Vehicle: Political and Psychological Problems," by RAND psychologist, Paul Kecskemeti.

This obscure report—not typically cited in Air Force historical studies that pertain to this period—dealt with the "probable political effects resulting from the launching of a satellite vehicle under United States auspices." Kecskemeti's thesis was simple, but critically important: "because of the political implications of the satellite instrument, it is of prime importance what we say about it, in addition to what we do with it."²⁷

Kecskemeti's paper cautioned against conducting all satellite operations under a shroud of secrecy. Public acknowledgment of American satellite activities would not only garner political prestige among allies and neutral nations but, more importantly, *it would maximize the nation's political leverage against the Soviets*. The ability to openly conduct "successful reconnaissance operations . . . would result in a significant political payoff. . . . If the Soviet leaders were to realize that [their] secrecy had been lost, . . . [this] loss of secrecy would increase the effectiveness of deterrence, [and] would also contribute to the effectiveness of direct political pressure upon the Soviet Union." But Kecskemeti also recognized that "satellite operations designed to gather visual information in Soviet territory, if they become known to the Soviet leaders, will be construed by them as a 'consummated act of aggression.'" However, since technical and physical limitations exist such that the satellite is unable to carry a warhead, it therefore "cannot be considered as a weapon." Thus to counter the likely Soviet reaction, he recommended that America publicly promote "the 'peaceful' nondestructive nature of the satellite [with] emphasis placed on the scientific and technological achievement which a successful 'artificial moon' represents." Kecskemeti concluded with a plan of action favoring "advance publicity rather than secrecy, as well as the launching of a first experimental satellite over the Equator [to establish a non-sovereignty precedent for outer space.]" Subsequently, "a second one [could be launched] on an oblique orbit to be used for intelligence purposes."²⁸

Kecskemeti's treatise was remarkably prescient and concise. Unfortunately, with satellite operations still far out on the horizon, his analysis of the political and psychological implications of these operations were likely considered within Air Force circles as somewhat premature. Appearing when it did, with an Air Force focused on strategic attack and struggling

with near-term issues of seemingly greater importance, Kecskemeti's paper apparently became "lost in the shuffle." It is ironic that by the end of 1950, the Air Force's own research support team had built the intellectual argument that, because it remained unrecognized, eventually reined in the aerospace concept.

One final encouraging sign within the Air Force with respect to the aerospace concept during this period was a critical decision to move Air Force R&D responsibilities out from under the auspices of AMC. The decision was a consequence of the similar findings of two concurrent 1949 studies, one a von Kármán initiated panel headed by Dr. Louis N. Ridenour, the other an Air University sponsored review, each established to assess the Air Force's R&D organizational structure. Both groups concluded that the development of future technology was essential to the continued well-being of the service, but that this function could not compete against the daily focus of manpower and resource requirements also managed by AMC. Consistent with these findings, on 23 January 1950, now Chief of Staff Vandenberg established the Air Research and Development Command (ARDC).²⁹ The removal of R&D from the competitive environment of the Air Force's day-to-day logistical issues would better facilitate the development of the aerospace concept's advanced technologies. While there was still no recognition given to the relationship between ICBM and satellite development, the technological push element of the aerospace concept now had a new and organizationally more powerful home.

From 1947 to 1950, external and internal contextual pressures upon the Air Force offered scant room for further development of the aerospace concept. The technological advancements required to push the concept along existed on paper; and, with regard to satellites, even continued to develop somewhat. Lacking, however, was an affluent financial environment within which these technologies could evolve into hardware. The aerospace concept's pull element suffered similarly. While its foundational theory was still present, budget austerity had beset Arnold's far-reaching vision with an acute case of nearsightedness. However, two geopolitical events had occurred toward the end of this period that offered new fiscal life to a concept virtually neglected over the previous three years. In August 1949 the Soviets successfully tested the atomic bomb, and in June 1950 the North Koreans launched an invasion to unify the Korean peninsula.

Aerospace Recovered?

These two events generated two significant responses from the American government that, in turn, reestablished an environment conducive to the development of the aerospace concept. First, with the Soviet Union now in possession of a nuclear capability, the character of the Kennan-Nitze security strategy debate began to change. The defense force which was deemed sufficient in 1947 to contain Soviet aggression became subject to reevaluation. North Korea's invasion in June 1950 gave conservative strategists the final political leverage they needed. Nitze's report calling for the "rapid and sustained build-up of the political, economic, and military

strength of the free world" entered history three months later as NSC 68; and defense spending tripled.³⁰

NSC 68's influence on R&D was almost immediate. In the wake of the Korean invasion and consistent with the new policy, Congress released huge appropriations to DOD. A portion of these funds flowed into the Air Force's R&D budget, increasing it to a FY 1950 amount of \$238 million. The following year, this figure doubled to \$522.9 million.³¹ ARDC's newly acquired wealth, in turn, provided the resource conditions necessary within which the aerospace concept could again be revived.

Second, with Soviet nuclear parity now looming on the horizon, Truman felt compelled to maintain an American advantage. On 31 January 1950, he authorized the commencement of thermonuclear research and testing. Within 18 months, atomic physicists verified its feasibility and proved it in November 1952 with the first successful detonation of a thermonuclear device.³² Converting this device into a warhead would require still more time; but the promise of a fusion weapon, not only more powerful but also significantly lighter than its fission predecessor, relaxed both the thrust and accuracy requirements of a nuclear-capable ballistic missile. Hydrogen bomb development breathed new life into the Air Force's ICBM advocates. In January 1951 ARDC reopened a contract with Convair, killed three and one-half years earlier, to again study rocket propulsion options.³³ Research interest in satellite reconnaissance, however, remained subdued, in large part because of the influence of Col Richard S. Leghorn.

Colonel Leghorn flew World War II reconnaissance missions over Normandy in preparation for the Allied invasion and left the service following the war's conclusion, but not before having established a sound reputation as an integrative thinker on reconnaissance. It was his reputation and experience that in April 1951 recalled him to active duty during the Korean War. Leghorn was made the chief of ARDC's Reconnaissance Systems Branch and tasked to review the Air Force's reconnaissance requirement and procurement plans.³⁴ In three months time, he submitted an initial report titled, "Comments on Intercontinental Reconnaissance Systems, 1952-1960." Leghorn's assessment of the Air Force's future reconnaissance requirements was not unlike that expressed in General Arnold's vision five and one-half years before.

A short intense campaign as contemplated by SAC requires the collection of as much planning information as possible prior to "D"-Day. As the SAC striking capability improves with improved development and production of atomic weapons and high performance, invulnerable vehicles, need for Pre-"D"-Day intelligence assumes even greater relative importance.

Vehicles for Pre-"D"-Day Reconnaissance must meet the following requirements:

1. Minimum chances of detection.
2. Minimum chance of interception.
3. An unmanned vehicle is greatly preferred.
4. The vehicle configuration must lend itself readily to a cover plan excuse such as a scientific or weather mission gone astray.

Whether or not the State Department will acquiesce in the use of any of these vehicles, the Department of the Air Force must fully develop a technical capability for Pre-"D"-Day Reconnaissance.³⁵

Leghorn's report went on to survey the reconnaissance vehicle possibilities available to the Air Force. Of RAND's earth satellite option, he said, "[the] concept does not offer sufficient promise today to justify the expenditure of development funds by the Air Force." Thus he held AMC's 1947 position for continued but limited studies, advocating instead that the Air Force pursue more preferable options of guided missiles, balloons, drones, and manned aircraft—all of which could achieve intercontinental capability through B-36 air launching or in-flight refueling.³⁶

His work caught the attention of the Air Staff; and in the fall of 1952, Colonel Leghorn moved to the Development Planning Office at the Pentagon on a by-name transfer request from the office's director, Col Bernard A. Schriever. Here Leghorn began work on a broader vision, developing the technical and political strategy requirements for what he described as Pre-D-Day intelligence. He also became the Air Force's principal liaison officer with RAND on long-range reconnaissance requirements.³⁷ Both his work and his exposure to RAND would have significant influence in the coming years.

Meanwhile, as new resources flowed into the Air Force and signs of a renewed interest in pursuing ballistic missile technology emerged, the broader and more immediate requirement to support a limited war in Korea while maintaining a global strategic attack capability continued to focus Air Force leadership on near-term issues. Consequently, while the ground became financially fertile once again to enable airmen to resume pushing their operational domain outward, the visionary encouragement necessary to pull this concept along remained somewhat blurred.

Indicative of the Air Force's focus as Truman's presidency came to a close is the following excerpt from a telling *Saturday Evening Post* article appearing on 17 February 1951. "Believing that the American people needed to know the facts the nation's air power, and the relationship of the Korean War to global responsibilities," Air Force Chief of Staff Vandenberg published "The Truth about Our Air Power."³⁸ In it he wrote:

In the Atomic Age, more than ever before, a strong offense is the best defense. . . .

Our stockpile of A-bombs is not the sole deterrent to aggression. It is our ability to deliver the bomb anywhere in the world that has been forestalling international communism's avowed design for world domination. Our strategic air power, poised to ram the atomic bomb down the throat of an aggressor in the event it is used against us, has been the cork keeping communism from spilling over the democratic nations.

The muscle of our strategic air arm is the B-36, which has more speed, range, armament and carries a heavier bomb load than any big plane in operation today.³⁹

General Vandenberg's article about airpower offered the American people no vision of an Air Force future in rockets or satellites. Instead, it was partly an educational piece about the uniqueness of airpower, partly an advocacy piece for airpower's role in the nation's defense, and partly a justification piece for the need to advance the air fleet into jet-powered propulsion. However, Vandenberg was not hiding a formidable assembly of aerospace secrets. As Truman stepped down from office in January

1953, the Air Force's aerospace program consisted of a collection of in-depth RAND reports on the satellite and a single ballistic missile program that was still two and one-half years away from its first test flight. The Army, on the other hand, had already touched space; and the Navy was preparing to do the same.

If in the summer of 1947 the aerospace concept appeared to be taking hold within the Air Force, encouraged by Air Force leaders clearly thinking about the prospect of an operational domain that naturally extended beyond the atmosphere, within three years the concept had all but died. By the beginning of 1953, though external conditions had developed to offer the potential to revive it, the concept had lost the momentum it had carried five and one-half years earlier. ARDC had become its organizational guardian, but the focus of Air Force leadership had waned considerably. However, a new president would bring a New Look to the forefront. With a top-down refocus on strategic attack capitalizing on the efficiency of technology, the aerospace concept would reemerge in full force. Unfortunately for the Air Force, this new president would also craft an alternative concept for the vertical.

Notes

1. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1997), 103.

2. George Kennan [X, pseud.], "The Sources of Soviet Conduct," *Foreign Affairs*, July 1947, 572-80.

3. "NSC-68," 14 April 1950, in *Foreign Relations of the United States*, 1950, vol. 1, 234-92. Quotes from 234, 237, 285, and 291 as cited by McDougall, 104.

4. "Survival in the Air Age: A Report by the President's Air Policy Commission" (Washington, D.C.: Government Printing Office, 1948), 6, 8-9, 23, as cited in Robert Frank Futrell, *Ideas, Concepts, and Doctrine: Basic Thinking in the United States Air Force 1907-1960* (Maxwell Air Force Base [AFB], Ala.: Air University Press, 1989), 228-29.

5. Walton S. Moody, *Building a Strategic Air Force* (Washington, D.C.: Air Force History and Museums Program, 1996), 162-66; and McDougall, 88.

6. Verbatim report, Sixth Meeting of the Air Board, 9-10 September 1947, 220, RG 340, Air Board, Minutes of Meetings, 1946-1948, Box 18, MMB, NA, as cited in Moody, 166.

7. *Ibid.*

8. "Secretary Forrestal Announces Results of Key West Agreements, 26 March 1948" (n.d., located in Air University Library, Maxwell AFB, Ala.), 9, 12. The resulting potential ambiguity between the Air Force and the Navy over which service owned the strategic attack role was clarified in a subsequent amendment to the Key West Agreement that appeared three months after it was signed. On 1 July 1948, Secretary Forrestal issued a memorandum for record that said "the Navy's requirement for . . . forces . . . would not be the basis for the development of a strategic air force. On the other hand, the memorandum also included the statement that 'although strategic air warfare was assigned to the Air Force as a primary function, it was agreed that the Navy should not be denied the air necessary to accomplish its mission.'" Quoted from "Chronology of Changes in Key West Agreements, April 1948-January 1958," prepared by the Historical Section, Joint Chiefs of Staff on 7 February 1958, 9.

9. "Chronology of Changes," 10, 12.

10. Robert L. Perry, *Origins of the USAF Space Program, 1945-1956*, V, History of DCAS 1961, Air Force Systems Command (AFSC) Historical Publications Series 62-24-10 (Los Angeles: AFSC, Space Systems Division, 1961), 30.

11. *Ibid.*, 23.

12. *Ibid.*, 30.

13. John Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1, *Organizing for Exploration* (Washington, D.C.: National Aeronautics and Space Administration History Office, 1995), 14; and David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, Colo.: Air Force Space Command, 1995), 17.
14. *Ibid.*, 19.
15. "Chronology of Changes," 12, 14.
16. Logsdon, 15.
17. James Forrestal, *The Forrestal Diaries*, ed. Walter Millis (New York: Viking Press, 1951), 467, as cited in Futrell, 199.
18. *Ibid.*, 248.
19. Spires, 27.
20. Milton W. Rosen, *The Viking Rocket Story* (New York: Harper & Brothers, 1955), 236.
21. Moody, 126.
22. *Ibid.*, 129.
23. McDougall, 97. Futrell cites the FY 1947 Air Force missile budget figure even lower (\$13 million), 482.
24. Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 48.
25. Spires, 26.
26. Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, R-3692-RC (Santa Monica, Calif.: RAND, September 1988), 9-19, as cited in Spires, 27-28.
27. Paul Kecskemeti, *The Satellite Rocket Vehicle: Political and Psychological Problems*, RM-567 (Santa Monica, Calif.: RAND, 4 October 1950), v, 5.
28. *Ibid.*, v, 19.
29. Futrell, 276-78.
30. McDougall, 104.
31. Futrell, 487.
32. Edmund Beard, *Developing the ICBM* (New York: Columbia University Press, 1996), 142.
33. Spires, 23.
34. Davies and Harris, 31, 39.
35. Richard S. Leghorn, memorandum to Reconnaissance Systems Branch, subject: Comments on Intercontinental Reconnaissance Systems, 1952-1960, Wright Field, Dayton, Ohio, 10 July 1951, 54 WCLF-286, 1, as cited in Davies and Harris, 37.
36. *Ibid.*, 37, 38.
37. *Ibid.*, 33.
38. Futrell, 300.
39. Hoyt S. Vandenberg, as told to Stanley Frank, "The Truth about Our Airpower," *Saturday Evening Post*, no. 34, 17 February 1951, 100.

Chapter 4

Aerospace versus Eisenhower (1953–58)

History is on our side. We will bury you!

—Nikita Khrushchev

President Eisenhower's opening security strategy for the cold war, popularly known as the New Look, established a policy that gave top priority to strategic nuclear attack forces and placed a premium on state-of-the-art technology. Consequently, the aerospace concept found fertile ground under the new administration. Within the first two years of Eisenhower's arrival, aerospace technologies moved from paper into substantive programs; and ICBMs found their way to the top of the nation's developmental priority list. But from the new president's past came an acute understanding that generals fight the wars statesmen fail to prevent.

Underlying Eisenhower's *statesman's* cold war strategy, there existed a fundamental quest for—if not peace—then at the very least the desire to establish a more relaxed state of tension between the two superpowers. From this desire, Ike's vision for space evolved. It began to appear in 1954 and continued to develop throughout the remainder of this study's period of focus. By the time the word *aerospace* first entered Air Force lexicon, space for peaceful purposes was being recognized throughout the world as America's national objective for man's newest frontier.

The historical path through these developments is complex, intermingled, and in many ways ironic. To begin, this chapter opens with a discussion on the Eisenhower administration's cold war security strategy and then reviews how the aerospace concept began to regain its momentum as a result. Next, it explores this study's most critical period: the series of events and decisions that transpire between mid-1954 and the appearance of sputnik in October 1957. At the national level, Eisenhower's space policy emerges. At the horizontal level, interservice competition for scarce resources continues to challenge the aerospace concept. And within the Air Force, the concept's technologies enter an accelerated phase of development. The chapter then explores how sputnik served as the catalyst from which policy, legislation, and organizations are formed, most of which counter the aerospace concept's most basic premise. Finally, with the appearance of the word itself, the history of the development of the aerospace concept comes to a close.

Eisenhower's Cold War Strategy

The national security strategy of the Eisenhower administration took shape during the presidential transition period in late 1952 when Eisenhower took key members of his designated cabinet aboard the cruiser *Helena* to ponder the world they faced. His team recognized that the United

States was caught in the horns of a complex strategic dilemma. Backing down from the communist challenge, especially now, given the Soviet's growing capacity to wage nuclear war, threatened the survival of the free world. But the alternative of remaining engaged in the cold war arms race only posed another set of bleak futures. One, if arms race tensions cascaded into open hostilities, which would impale America on the horn of physical destruction. The other, if the arms race spiraled out of control, it could gut America on the horn of economic bankruptcy. In 30 years government spending had grown from \$4 billion to \$85.5 billion per year, 57.2 percent of which defense now absorbed. Defending America was endangering the nation's economy as much as inadequate arms might endanger the security of the free world.¹

From the *Helena* cruise came Eisenhower's Great Equation, which laid the foundation for his developing strategic policy. America would prepare for the long haul, optimizing the health of the economy with the essential but least costly military forces.² The administration team crafted this basic framework into the New Look, putting into motion a security strategy that would put the least strain on the national economy. Embodied as policy in October 1953 under NSC 162/2, Eisenhower confronted the Soviet threat by accepting inferiority in conventional military forces offset with an emphasis on nuclear strategic striking power and technological superiority.³ Eisenhower's centerpiece of the New Look became known as Massive Retaliation.

Defense spending was sharply cut. The New Look called "at the same time for demobilization of a quarter of all men under arms and a drop in military spending of 30 percent over four years! The only service to be spared was the USAF, which provided 'more bang for the buck.'"⁴ The general character of this strategy was not unlike Truman's strategic decisions reached six years earlier. Where Eisenhower differed fundamentally from Truman, however, was in his desire to address the more basic dilemma of the cold war—that between confrontation, arms race or otherwise, and peace.

The fundamental motivation for this desire was Ike's early recognition that his New Look policies, "designed to minimize the impact of the Cold War on domestic life, also pushed the country further along the road to technocracy."⁵ It was this recognition that compelled him, during the course of his presidency, to craft a broader strategy for peace. Eisenhower's chosen approach would evolve to override the aerospace concept's basic premise.

The strategy's logic and philosophical foundations initially appear in Eisenhower's first public address as president, presented on 16 April 1953 before the American Society of Newspaper Editors. Taking advantage of the political opportunity afforded by the death of Stalin the month prior, Ike delivered what became known as his Cross of Iron speech. Commenting on the different paths chosen between the Soviet Union and America following their combined defeat of Germany in World War II, he described the cold war as both tragic and ironic. In the resulting arms spiral that threatened the entire world, the Soviet Union had come to share and suffer the very fear it had fostered in the rest of the world. Eisenhower's address continued:

What can the world, or any nation on it, hope for if no turning is found on this dread road?

The worst to be feared and the best to be expected can be simply stated. The worst is atomic war. The best would be this: a life of perpetual fear and tension; a burden of arms draining the wealth and the labor of all peoples; a wasting of strength that defies the American system or the Soviet system or any system to achieve true abundance and happiness for the peoples of this earth.

Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children. The cost of one modern heavy bomber is this: a modern brick school in more than 30 cities. It is two electric power plants, each serving a town of 60,000 population. It is two fine, fully equipped hospitals. It is some 50 miles of concrete highway. We pay for a single fighter plane with a half million bushels of wheat. We pay for a single destroyer with new homes that could have housed more than 8000 people. . . .

This is not a way of life at all, in any true sense. Under the cloud of threatening war, it is humanity hanging from a cross of iron. . . .

So the new Soviet leadership now has a precious opportunity to awaken, with the rest of the world, to the point of peril reached and to help turn the tide of history. Will it do this? We do not yet know. Recent statements and gestures of Soviet leaders give some evidence that they may recognize this critical moment.

We welcome every honest act of peace. We care nothing for mere rhetoric. We care only for sincerity *of peaceful purpose attested by deeds*. The opportunities for such deeds are many. (Emphasis added)⁶

In essence, Eisenhower saw the cold war transforming America into the image of her enemy. Eisenhower the statesman came to envision his place in history secured by finding a peaceful solution to this ideological quagmire.

Early in his presidency, Ike began the search for a vehicle that would allow both sides to pull back from the threat of violent confrontation. In two years time, space for peaceful purposes would begin to emerge as that vehicle. But the path to securing it would be a delicate one. Four months after Eisenhower delivered his hopes, the Soviet Union successfully ground-detonated Joe-4, which *they* claimed was the world's first thermonuclear bomb.⁷

Aerospace Developments under the New Look (1953-55)

In the spring of 1954, General White, the Air Force vice chief of staff, described Eisenhower's New Look policy as a realistic one. "We have recognized," he wrote, ". . . our atomic weapon developments form the only effective counter to the overwhelming mobilized manpower of the Soviets. Our Air Force with its ability to deliver nuclear weapons has been recognized as an instrument of national policy. . . . [A]cceptance of these truths has been the result of startling advances in the power of modern weapons."⁸

Strategic attack remained the cornerstone of America's defense under the New Look. The aerospace concept would find room to develop.

Eisenhower's national security strategy, like Truman's, leaned heavily upon airpower. The general strategy of massive retaliation, however, lent even more support to the development of the ICBM. The system's swift response capability, potency, and relative indefensibility gave missile advocates a strong argument—within an environment of New Look proponents—for its further development. Additionally, with the requirement for and nature of war plans under this general strategy, the Air Force began to recognize a greater need for accurate targeting intelligence *prior* to the initiation of hostilities. Thus the reconnaissance satellite also profited from the early fifties New Look environment. However, both of these aerospace systems, under the guidance of a single Air Force command devoted specifically to R&D, continued to develop separately—the ICBM garnering a higher priority as a critical asset for strategic attack, with the satellite sitting significantly lower in priority as an expensive support asset. Also during this period, a third aerospace system emerged within ARDC to capitalize on hypersonic boost-glide technology. These developments occurred within the Air Force during the first two and one-half years of the Eisenhower presidency and began almost as soon as he took office.

Shortly following Eisenhower's inauguration, Air Force Secretary Harold E. Talbott tasked Trevor Gardner, his 37-year-old special assistant for R&D, to undertake a study of the military's guided-missile programs.⁹ Gardner had participated in the Manhattan Project during World War II. He was smart, energetic, had a penchant for working around bureaucratic friction, and soon became convinced of the critical need to develop the ICBM.

In November 1953 Gardner gathered a group of scientists and engineers into what became informally known as the Teapot Committee. Tasked to study the impact of thermonuclear technology on missile development and to assess Soviet advancements in the field, the committee submitted its report on 10 February 1954.¹⁰

The Teapot report expressed grave concern over strengthening Soviet defenses against the SAC's manned bombers. Furthermore, it warned of the growing potential of a Soviet ICBM program, especially in light of their success with thermonuclear technology six months prior. To meet this threat, the Teapot Committee concluded that the Air Force could have an Atlas ICBM operational in five to six years *if* the service gave Atlas its highest priority *and* centralized the system's development. To facilitate this the committee recommended consolidating the Atlas program under a new Air Force agency dedicated solely to managing and advocating the program's growth.¹¹

Gardner, armed with the Teapot report and having had a year to study the ICBM issue himself, thus began an intensive lobbying campaign within the Air Force and DOD to energize support for Atlas. In May 1954 he convinced Air Force chief of staff Nathan Twining to assign Atlas the Air Force's highest developmental priority and to direct ARDC to establish an independent ballistic missile organization. Effective 1 July 1954, the Western Development Division (WDD) opened its doors in California, conveniently located near the Atlas program's technology base. Gardner was

also instrumental in selecting the division's first and only chief, Brig Gen Bernard A. Schriever.¹²

On 1 April 1954, a third aerospace program officially appeared within ARDC. Two years previously, Bell Laboratories approached the Air Force with a proposal for a rocket-powered piloted aircraft that would accelerate in space to hypersonic velocities and then glide its way around the globe to its target. ARDC had initially shown lukewarm interest in the proposal; however, after repeated knocks on the door by Bell, coupled with the subsequent developing interest in ICBMs, ARDC became convinced that Bell's concept merited further study. Bell was awarded a one-year contract to study the feasibility of the manned bomber-missile (BOMI). As a boost-glide bomber-reconnaissance aircraft, BOMI's concept called for a three-stage rocket propulsion system—two stages used to launch and accelerate the aircraft and one stage to return the craft home.¹³ Launching under rocket power and recovering as a glider, BOMI marked the Air Force's first serious study of a system that offered the potential to operate throughout the expanse of the aerospace environment.

Meanwhile, the Air Force's position on reconnaissance continued developing within the Air Staff under the influence of Colonel Leghorn. Prior to returning to civilian life in January 1953, Leghorn submitted a memorandum to Air Force chief of staff General Vandenberg. Expanding on his 1951 concept of Pre-D-Day Reconnaissance, his memorandum arguably established the Air Force's concept of strategic reconnaissance that remains in place still today.

Leghorn recognized and advocated an air strategy of disarmament to employ the Air Force's nuclear strategic attack assets against Soviet military forces in being, its military stocks, its logistics system, and its economy. His memorandum continued, "This requires a counterforce type war, which we have only begun to embrace in our planning. . . . Current development planning indicates the probable technical feasibility of such a disarmament concept. Our qualitative intelligence and reconnaissance capabilities constitute the primary problems, and without extraordinary action, these might delay adoption at operational planning levels of strategies with emphasis on counterforce operations."¹⁴ Since a nuclear counterforce war would likely be an expedient one, there existed a critical requirement to maintain a more robust peacetime intelligence and reconnaissance capability. Hence, Leghorn's key recommendation, and the legacy he left the Air Force, was to establish a vigorous program to develop these capabilities. "Immediate and vigorous steps [should] be taken to strengthen air intelligence and reconnaissance capabilities, which will be necessary before any sort of disarmament strategy can be contemplated."¹⁵

Significantly, while at the Air Staff, Leghorn was the Air Force's principal liaison officer with RAND Corporation on long-range requirements for reconnaissance.¹⁶ This affiliation no doubt led him to reverse the conclusion he drew in 1951 concerning the value of pursuing satellite reconnaissance technology. In his January 1953 memorandum to Vandenberg, Leghorn now included satellites within his framework of systems for the Air Force's future reconnaissance requirements.¹⁷ Leghorn's connection with RAND would have even broader implications in the coming years.

The memorandum's influence became apparent almost immediately. Two months after its submission to General Vandenberg, ARDC published its first formal design requirement for a high-altitude reconnaissance aircraft capable of safely penetrating the Soviet interior. This requirement was the genesis of what would evolve, in two years' time, into the U-2 program.¹⁸ Furthermore, in December ARDC established project 409-40, which pulled together the proliferating aspects of the Air Force's satellite program and turned it into a proposed system. Thus marks the beginning of the nation's first reconnaissance satellite.¹⁹

By November 1954 the Air Staff had articulated the formal system requirements for the satellite, now designated WS-117L (WS meaning weapon system).²⁰ With these requirements in hand, ARDC quickly responded with a formal development plan. On 16 March ARDC's Bombardment Missiles Branch at Wright Air Development Center (WADC) published the *General Operational Requirement for the Advanced Reconnaissance Satellite*. The plan defined the objective of the satellite system as providing a means for continuous surveillance of "preselected areas of the earth" in order "to determine the status of a potential enemy's warmaking capability." The satellite would provide daylight visual coverage of airfields and missile launching sites in addition to offering an alternative capability to collect electronic intelligence and provide weather forecasting data. Initial projections expected WS-117L to be operational in 1965.²¹

Thus as the summer of 1955 approached, the aerospace concept's enabling technologies had moved out of their largely on paper status and into credible development programs. After two and one-half years under the New Look, Atlas sat atop the Air Force's R&D priority list; and the reconnaissance satellite program, first proposed nine years earlier, had finally become a reality. Furthermore, with the initiation of the BOMI program, the Air Force was beginning to explore the potential of a true aerospace vehicle. These three programs, however, remained geographically, organizationally, and doctrinally divorced from one another.

Atlas, WS-117L, and BOMI were all technologically dependent upon the rocket, both for boost as well as guidance control. However, Air Force planners either considered this fundamental relationship—first established by RAND in 1946—as relatively insignificant, or it simply remained obscure from their focus. The Atlas program was growing its roots in California at WDD under General Schriever, with ICBM development as the sole reason for the division's existence. The WS-117L and BOMI programs were located in Dayton, Ohio, at WADC—the Wright Air Development Center. Reconnaissance was heretofore an *air* function, and BOMI was considered an *aircraft*. Further separating the satellite from the ICBM was airpower theory and doctrine, which saw strategic reconnaissance as a *supporting* role for strategic attack. Consequently, the Air Force held WS-117L much lower in developmental priority than the ICBM.

In the coming months, Air Force leadership would address the organizational structure issues of these programs and thereby indirectly signal its position on their underlying doctrinal issues as well. But before discussing these events, by the summer of 1955 the Eisenhower administration had made a series of critical decisions that collectively created a fun-

damental challenge to the aerospace concept. Therefore, how and why these decisions were reached warrants review.

Birth of a National Space Policy (1954-55)

The period from spring 1954 through December 1955 is arguably one of the most remarkable (and in retrospect) successful periods in the history of twentieth-century American policy formulation. Within this time frame, various elements of a developing national space policy emerge that remain in place even today. With regard to this study, Eisenhower's midfifties policy developments had two opposite effects on the aerospace concept. On one hand, the ICBM was elevated to the highest national priority. On the other, strategic reconnaissance was drawn out of the Air Force; and the beginnings of a space for peaceful purposes policy emerged.

Five interrelated developments describe the foundations of Eisenhower's burgeoning strategy for space. The Technological Capabilities Panel (TCP) brought the critical need for ICBM, intermediate range ballistic missiles (IRBM), and strategic reconnaissance capabilities to national-level awareness. The TCP also spawned the U-2 program, which shifted control of strategic reconnaissance from the Air Force to the Central Intelligence Agency (CIA). Additionally during this period, growing interest in satellites from within the civilian scientific community reached the national level as America publicly decided to become involved in scientific satellite proposals planned for the upcoming International Geophysical Year (IGY), to be held between 1 July 1957 and 31 December 1958. The confluence of these three developments in turn generated America's first policy document on space, NSC 5520. Finally, Eisenhower's Open Skies proposal marked America's first credible peaceful gesture to the Soviets and signaled Eisenhower's intent to implement his broader cold war strategy. Ironically, the Air Force played an indirect but rather significant part in shaping most of the developments that collectively began to challenge the aerospace concept.

The TCP first convened in July 1954. Its genesis occurred when Gardner, armed with the Teapot report, persuaded the Office of Defense Management's Science Committee (ODMSC) to examine the threat of a Soviet surprise attack. Motivated by Teapot's conclusions, key members of ODMSC secured a meeting with President Eisenhower in March and again in July, finally convincing him that a major study was warranted.²² On 26 July, Eisenhower wrote a personal letter to the president of Massachusetts Institute of Technology James R. Killian asking him to direct the assessment of America's security architecture.

Killian assembled 50 of the nation's leading military, industrial, and scientific minds into the TCP. They divided into three project teams: Strike Forces, Continental Defense, and Intelligence—the latter chaired by Edwin H. Land of the Polaroid Corporation.²³ The panel officially reported to the president six months later on Valentine's Day 1955. "By all published accounts, [their] report affected the course of national security affairs enormously."²⁴ Of particular importance to the development of the aero-

space concept were the findings of the Strike Force Panel and the Intelligence Panel.

The Strike Force Panel echoed Teapot's findings for the Air Force the prior year. It recommended that highest national priority be given to the Air Force's ICBM program. Furthermore, the panel urged the development of an arsenal of both land- and sea-based IRBM as well.²⁵

Perhaps most important were the recommendations from the Intelligence Panel. The Land Panel, as it was also known, recognized a subtly different role for strategic reconnaissance than the Air Force held. It reported, "We must find ways to increase the number of hard facts upon which our intelligence estimates are based, to provide better strategic warning, to minimize surprise in the kind of attack, *and to reduce the danger of gross overestimation or gross underestimation of the threat.* To this end, we recommend adoption of a vigorous program for the extensive use, in many intelligence procedures, of the most advanced knowledge in science and technology" (emphasis added).²⁶

The Land Panel strongly supported the development of reconnaissance satellites. Furthermore, it recommended beginning an immediate program to develop a small scientific satellite in order to establish for subsequent military systems the principle of "freedom of space" in international law.²⁷ But reconnaissance satellites were still years away from being operational. For recommendations concerning the period in between, the report's conclusions were conspicuously silent.

In fact, Land himself had taken a proactive role with regard to establishing an interim reconnaissance capability. During the six months of panel hearings and investigations, Land became aware of both the critical need for accurate intelligence and the existence of technology that could quickly fill this need.

During hearings in the fall of 1954, ARDC briefed the Land committee on the status of its high-altitude reconnaissance aircraft program initiated a year and one-half earlier. The Air Force had rejected proposals from Fairchild, Martin, and Lockheed and had just awarded Bell Laboratories a contract to build the X-16. Bell expected the aircraft to be operational in early 1956. ARDC told the Land Panel that it had dismissed Lockheed's U-2 proposal because the engine Lockheed had in mind would not be powerful enough to meet the mission specifications ARDC's requirements demanded.²⁸

The following day, Kelly Johnson, the U-2's chief designer, appeared before the Land Panel arguing that if the Air Force could provide the requisite engines, he could have a prototype built within eight months after the go-ahead. For Land, time was more critical than Air Force requirement standards. He was able to convince the TCP's chairman of this fact; and, subsequently, both he and Killian began canvassing the highest levels of government to garner support for Johnson's U-2.

On 5 November 1954, Land wrote CIA director Allen Dulles a memorandum titled "A Unique Opportunity for Comprehensive Intelligence." Of the U-2 Land said, "No proposal or program that we have seen in intelligence planning can so quickly bring so much vital information at so little risk and at so little cost. . . . We have been forced to imagine what [the Soviet's] program is, and it could well be argued that peace is always in dan-

ger when one great power is essentially ignorant of the major economic, military, and political activities . . . of another great power. . . . We cannot fulfill our responsibility for maintaining peace if we are left in ignorance of Russian activities."²⁹ Land's memorandum was convincing. Dulles resolved to get the CIA into the aerial reconnaissance business.³⁰

Meanwhile, Killian and Land had together been meeting privately with President Eisenhower. They convinced him of the U-2's capability to fill the nation's need for Soviet intelligence.³¹ Their belief that strategic aerial reconnaissance was a CIA mission also fell on receptive ears. Killian noted many years later that Eisenhower was feeling the effects of the Air Force's use of reconnaissance to pry more funding out of Congress and therefore had strong reservations about the Air Force playing a primary role in the collection of intelligence. He did not want to allow the service to "compose its shopping list for weapons based on a threat assessment that came from intelligence it alone collected, processed, and interpreted."³²

On 24 November, Eisenhower gathered Allen Dulles, Secretary of State John Foster Dulles, Defense Secretary Charles Wilson, Air Force Secretary Talbott, and Air Force chief of staff Twining in the oval office to craft the rudimentary organizational architecture for the first national strategic reconnaissance program.³³ Code-named Aquatone, the U-2 program would be controlled by the CIA supported with pilots, maintenance, and parts by the Air Force and enshrouded in deep secrecy. Hence no mention of it appeared even in the TCP's final classified report. CIA director Dulles selected Richard M. Bissell Jr., to head Aquatone, and the Air Force forwarded Col Osmond J. Ritland as the Air Force's liaison.³⁴ It would be an effective combination—the two would later manage America's first reconnaissance satellite program as well. On 9 December 1954 a contract was signed with Lockheed for 20 planes at a total cost of \$22 million.³⁵ Most eyes within the Air Force merely saw the X-16 program die. What was not so well known was that the Air Force had been flanked and that the CIA now controlled strategic aerial reconnaissance.³⁶

Thus by February 1955 national-level influence on the development of the aerospace concept was beginning to take a discouraging turn. True, the TCP had convinced the president of the importance of the ICBM. But ballistic missiles were not the answer to Eisenhower's cold war dilemma. More important was the need for accurate intelligence in his effort to control the arms race. In effect, the Land Panel's recommendations *represented an inversion of the Air Force's perspective on strategic reconnaissance*.³⁷ Where the Air Force held strategic reconnaissance as a support function in its primary mission of strategic attack, Eisenhower came to see this relationship reversed. In this regard, as the Land Panel highlighted the potential of satellites, Eisenhower was beginning to recognize space for its potential to break the cold war impasse between America and the Soviet Union. Furthermore, concurrent developments under way in the international scientific community were helping to clarify Eisenhower's vision.

As mentioned previously, one month prior to Eisenhower's election American scientists had proposed an idea to launch a satellite in the name of cooperative international science during the coming IGY. The proposal was accepted by the International Council of Scientific Unions

(ICSU) at their 1952 convention in Rome. Since then, various lobbying efforts had been under way around the world to garner support for the project. By August 1954 the American Congress voted to sanction US participation in the IGY; and shortly thereafter, the IGY special committee recommended that thought be given to participating in the IGY satellite effort. The House of Representatives subsequently began considering the release of public funds to support American scientists in that effort.³⁸ Two months later the ICSU's committee for IGY recommended to the world's governments that nations try to launch earth satellites during the geophysical year in the interest of global science.³⁹ The convergence of the TCP report's intelligence findings and a growing public interest in an IGY satellite generated a requirement within the administration to begin establishing policy on outer space.

On 20 May 1955, the National Security Council signed NSC 5520, "Draft Statement of Policy on U.S. Scientific Satellite Program." It represented America's first official space policy statement. Excerpts significant to this study follow:

The U.S. is believed to have the technical capability to establish successfully a small scientific satellite of the earth in the fairly near future. . . .

The report of the Technological Capabilities Panel . . . recommended [phrase excised during classification review] an immediate program leading to a very small satellite in orbit around the earth, and that re-examination should be made of the principles or practices of international law with regard to "Freedom of Space" from the standpoint of recent advances in weapon technology. . . .

Considerable prestige and psychological benefits will accrue to the nation which is successful in launching the first satellite. The inference of such a demonstration of advanced technology and its unmistakable relationship to inter-continental ballistic missile technology might have important repercussions on the political determination of free world countries to resist Communist threats, especially if the USSR were to be the first to establish a satellite. *Furthermore, a small scientific satellite will provide a test of the principle of the "Freedom of Space."* . . . It should be emphasized that a satellite would constitute no active military offensive to any country over which it might pass. . . . *The U.S. should emphasize the peaceful purposes of the launching of such a satellite,* although care must be taken as the project advances not to prejudice U.S. freedom of action to proceed outside the IGY. (Emphasis added)⁴⁰

Interestingly, in the current declassified version of NSC 5520, very little is mentioned with regard to the Air Force's reconnaissance satellite program. It is clear, however, that the administration was considering this program as of May 1955. NSC 5520 noted in its "Courses of Action" section that while the Defense Department would initiate the IGY program, "this program would not prejudice continued research [phrase excised during classification review] or materially delay other major Defense programs."⁴¹ However, while small portions of this document remain excluded from the public domain—which no doubt refer to the Air Force's satellite plans—one must remember that the Air Force had released its first "General Operational Requirement for the Advanced Reconnaissance Satellite" only two months prior to NSC 5520's appearance. Furthermore, in the proposal ARDC projected the system would not be operational for another 10 years.

The significance of these observations is to indicate that WS-117L was in all likelihood not yet a national developmental priority in Eisenhower's mind, as some histories of the period suggest. Decidedly, reconnaissance was critical to him. The U-2 program is evidence of that. But the Air Force's satellite proposal would not be folded into Eisenhower's reconnaissance apparatus for another three years yet. In the meantime, as will be shown later in this study, within the Air Force the satellite would continue to hold a back seat to its ICBM program.

America's first space policy thus secretly set forth two goals of high national importance—establishing the legality of the principle of freedom of space and becoming the first nation to get there.⁴² But it also represented the beginning attempts by Eisenhower to protect space from becoming the next area of escalation in the cold war arms race. Space for peaceful purposes was not yet firmly established as a national policy, but NSC 5520 laid the foundation for this policy to evolve in the future. If the Soviets could have seen this document, they no doubt would have interpreted it as mere rhetoric rather than an honest act of peace. Eisenhower's next major policy proposal would attempt to show the Soviets his sincerity of peaceful purpose attested by deeds. With his proposal to open the skies over both the United States and the USSR, Ike would attempt to shift the critical reconnaissance needs of both nations out of the secret realm of espionage.⁴³

Eisenhower offered his Open Skies proposal to the Soviets on 21 July 1955 at the historic Geneva Summit Conference. The idea, however, originated from a much broader policy proposal than simply mutual aerial inspection. Five weeks prior to the Geneva Summit, Nelson Rockefeller, at the time a special assistant to the president, had gathered a group of advisors together to craft a strategy for the upcoming conference. The Quantico Panel, as this group was called, developed a series of proposals with which to gauge Soviet intentions. Each of the proposals was serious but represented "a spectrum of degree of difficulty for the Soviet Union to accept unless its intentions were, indeed, pacific." If the Soviets were willing to cooperate only at the lower range, then it would signal for a much more energetic military and foreign policy. Eisenhower didn't buy the Quantico report's complete plan—just the open skies idea.⁴⁴

The following month at Geneva, in front of the heads of state from Great Britain, France, and the Soviet Union, President Eisenhower departed from a statement prepared the night before by his special assistant on disarmament, Harold E. Stasson.⁴⁵ Semi-impromptu, Eisenhower surprised the world with the following proposal (in his words):

I should address myself principally to the delegates from the Soviet Union, because our two great countries admittedly possess new and terrible weapons in quantities which do give rise in other parts of the world, or reciprocally, to the fears and dangers of surprise attack.

I propose, therefore, that we take a practical step, that we begin an arrangement, very quickly, as between ourselves—immediately. These steps would include:

To give to each other a complete blueprint of our military establishments, from beginning to end, from one end of our countries to the other; lay out the establishments and provide the blueprints to each other.

Next, to provide within our countries facilities for aerial photography to the other country—we provide you the facilities within our country, ample facilities for aerial reconnaissance, where you can make all the pictures you choose and take them to your own country to study; you provide exactly the same facilities for us and we to make these examinations, and by this step to convince the world that we are providing as between ourselves against the possibility of great surprise attack, thus lessening danger and relaxing tensions.⁴⁶

Khrushchev dismissed Eisenhower's remarkable offer as "nothing more than a bald espionage plot. . . . [His] purpose was evident—at all costs to keep the U.S.S.R. a closed society. He would permit no effective penetration of Soviet national territory or discovery of its military secrets, no matter what reciprocal opportunities were offered to him."⁴⁷ The Soviet "unwillingness to talk disarmament on each other's terms forced Eisenhower to prepare for the imminent missile age."⁴⁸ Eisenhower returned home and seven days later began to implement his space policy strategy.

On 28 July 1955, according to the plan laid out in NSC 5520 to proceed with maximum publicity of the scientific, international, and peaceful character of the program, White House press secretary James Hagerty declared America's intent to launch a satellite for the IGY.

On behalf of the President, I am now announcing that the President has approved plans by this country for going ahead with the launching of small earth-circling satellites as part of the United States participation in the International Geophysical Year which takes place between July 1957 and December 1958. This program will for the first time in history enable scientists throughout the world to make sustained observations in the regions beyond the earth's atmosphere.

The President expressed personal gratification that the American program will provide scientists of all nations this important and unique opportunity for the advancement of science.⁴⁹

Two days later, the Soviet Union announced a similar intent. The cold war, however, continued undeterred.

In November 1955 Russia successfully detonated an air-delivered hydrogen bomb, surpassing America's nuclear weapons development program by demonstrating their possession of credible ICBM warhead technology. Eisenhower responded on 1 December with a signature. He approved NSC 1484, which officially implemented the TCP's recommendation of 11 months prior to assign the Atlas ICBM and developing IRBMs joint highest national priority.⁵⁰

Two remarkable years for American policy development were 1954 and 1955. Between the TCP, the U-2, NSC 5520, Open Skies, and IGY, Eisenhower had crafted a delicate balance of directives, proposals, and initiatives through which he would steer his overarching cold war strategy throughout the remainder of his presidency. For the aerospace concept, however, this period foresaw its impending demise. The notion that the environment of air and space represented the Air Force's operational continuum was at the start of Eisenhower's presidency a valid—albeit distant—one. By the end of 1955, however, a space policy had begun to emerge that would directly challenge that notion. There is a great deal of irony in these developments, for evidence indicates that the Air Force indirectly affected the character of this policy.

With regard to the TCP and its subsequent encouragement of the U-2 program, Gardner's efforts were "instrumental in stimulating scientists advising the President to take an active role in identifying solutions to the problem of surprise attack."⁵¹ Besides prodding ODMSC to address the defense problem which subsequently evolved into the TCP, it was Gardner's personal encouragement and close support that brought Kelly Johnson to the Air Force with his U-2 proposal. Furthermore, following the Air Force's rejection of it, together "Johnson and Gardner [began lobbying] Edwin Land's technical intelligence group as soon as it was formed."⁵² Thus, Gardner, an Air Force advocate, was somewhat instrumental in the events that led to strategic aerial reconnaissance shifting to the CIA.

If Gardner's influence is somewhat tenuous, the Air Force's indirect role on NSC 5520 and Open Skies is profound. McDougall, in *The Heavens and the Earth* wrote that Kecschemeti's October 1950 RAND report "more than any other, deserves to be considered the birth certificate of American space policy."⁵³ The earlier summary of this document, presented in chapter 3, highlights the remarkable parallels between it and Eisenhower's midfifties space policy, not only in its basic strategy but even in the language used in NSC 5520 to record it. McDougall, however, left unresolved the connection between Kecschemeti's report and national space policy five years hence. The most likely bridge between the two was Colonel Leghorn.

While serving on active duty, Leghorn's work in future reconnaissance requirements and his additional position as the Air Force's chief reconnaissance liaison with RAND undoubtedly made him intimately familiar with RAND's satellite studies. Following his second retirement, Leghorn became an advisor to Stasson.⁵⁴ Stasson was a speechwriter for Eisenhower during his 1952 election campaign and afterward became the president's special assistant on disarmament.⁵⁵ Part of a small group of powerful voices in the articulation of policy to whom "Eisenhower entrusted a full and complete account of American foreign policy goals and methods," Stasson was present in Geneva when Eisenhower offered his Open Skies proposal.⁵⁶ Following his work with Stasson, Colonel Leghorn subsequently assisted U-2 program director Bissel "in efforts to anticipate and offset political resistance to aerial and satellite reconnaissance during the U-2 and satellite development activities in the late 50's."⁵⁷ The man largely responsible for developing the Air Force's *position* on strategic reconnaissance is likely the man who brought the Kecschemeti paper to the lap of national leadership.

Kecschemeti's report was written for, presented to, and apparently "sat" unobtrusively within the Air Force for more than four years. During this time, RAND had lobbied hard within the service for support of its reconnaissance satellite. RAND's argument was based largely on the satellite's political value; and, as such, it failed to generate interest within a service focused on strategic attack. What was disregarded as either unimportant or simply unrecognized ironically became a cornerstone of the nation's cold war security strategy five years later. Interestingly, Kecschemeti's paper was quietly withdrawn from RAND's publication list on 8 November 1955.

As space policy was being shaped at the national level, its effects were being felt in all three services. Missing from this chapter's discussion thus

far are the aerospace related events taking place during this time frame within the other two services.

Interservice Developments (1953-57)

Eisenhower's New Look, which emphasized strategic striking power and superior technology in exchange for decreased conventional capability, had not sat as well with the Army and Navy as it had with the Air Force. While the Navy had found some respite in its quest for a relevant mission during the Korean War—arguably the foundational experience for its present-day from the sea doctrine—the Army, “without a strategic nuclear mission, struggled with large cutbacks and the loss of institutional clout.”⁵⁸ The national-level policy developments discussed in the previous section, however, offered both services the opportunity to reengage the Air Force for control not only of the strategic attack mission but of satellites as well. The spark which ignited a new round of interservice battles occurred with the TCP report's recommendation to develop the IRBM.

Of significance, however, is that by February 1955 when the TCP report was released, the Air Force had already established a formidable amount of bureaucratic momentum with its burgeoning aerospace programs. Consequently, the interservice aerospace challenges that occurred during the midfifties, both in missiles and in satellites, did little to threaten the Air Force's hold on the strategic attack domain and by default, therefore, its aerospace concept. What the TCP report did do was stimulate an already rancorous climate among the services that Eisenhower's New Look policy had created. The impact of the interservice turf battles that follow in this discussion do not directly influence the development of the aerospace concept. They do influence, however, the perceptions of politicians and officials outside of DOD, who in three years time would be making policy decisions concerning the character of America's space program. Therefore, in order to describe the period's zeitgeist, a discussion of these events is relevant to this study.

In 1950 the Army's ballistic missile team, under the direction of von Braun, had established shop in Huntsville, Alabama, and moved directly into their follow-on system, the Redstone rocket. On 20 August 1953, seven months into a new presidency, the first of 36 Redstone launches (through 1958) lifted off from the shores of Cape Canaveral, Florida.⁵⁹ Von Braun and company maintained their lead in the American military's missile race. As work at the Redstone Arsenal continued, the rocket's range approached the 500-mile capability, which prompted another amendment to the Key West Agreement.

Still in search of the correct way to express role responsibilities, on 13 November 1954, DOD reiterated to the Army that its role was a tactical one. Their responsibility was the development of surface-to-surface missiles “designed for employment against tactical targets within the zone of Army combat operations.” An earlier amendment in 1951 had defined the Army's combat zone as “normally not to exceed 50 to 100 miles in depth.” The 1954 amendment continued, “Very long-range surface-to-surface missiles of the intercontinental type shall be developed, procured, and

employed by the U.S. Air Force."⁶⁰ The importance of this amendment was that it marked DOD's first official recognition that the Air Force had complete responsibility for the ICBM. Unfortunately, the amendment continued to leave undefined the gray area between tactical and strategic. Three months later, however, the TCP rectified the remaining ambiguity.

On 14 February 1955, Killian's panel released a report that defined the intermediate zone, into which the services and their missile programs poured. As part of its coherent plan for stimulating missile development, the TCP report recommended active pursuit of IRBMs for both land and shipboard launch.⁶¹ Implied in the text was the intent to capitalize on the positive benefits of interservice competition. In many respects, it worked.

The Army immediately responded with a new missile design. Dr. von Braun, now chief of the Army's Guided Missile Development Division, proposed plans for a new liquid-fueled Jupiter rocket. With twice the thrust of Redstone, it would have a 1,500-mile range capability.⁶² Preparing for the coming interservice battle for funding priority, the Army chose to maintain its "long-held position that a 1,500-mile missile was simply an extension of the range of modern artillery."⁶³ The Air Force held its strategic attack ground and entered the melee with a WDD-generated counter-proposal—Thor.

Acknowledging the intent of Killian's panel to encourage parallel development, yet seeking to maintain some semblance of order within the Pentagon, on 8 November 1955, Secretary of Defense Charles E. Wilson issued yet another Key West Agreement amendment (missile control amendment no. 5). "The Secretary of Defense assigned to the Air Force 'management responsibility for the conduct of a land-based IRBM (IRBM#1) development program.' At the same time he 'assigned jointly to the Army and Navy an IRBM (IRBM#2) program having a dual objective of achieving an early shipboard capability and also providing a land-based alternate to the Air Force program.'"⁶⁴

The secretary's implied signal of service priority was clearly communicated. Maj Gen John B. Medaris, then the Army's chief of ordnance at Huntsville wrote, "Somewhat to our chagrin, . . . [t]his was a clear indication that insofar as the land-based IRBM was concerned, the Army Jupiter was considered as a 'back-up' to the Air Force Thor."⁶⁵ Unfortunately, his read of the secretary's policy statement stopped short of foresight. General Medaris failed to discern the gloomy horizon facing the Army's missile program. When the Navy entered the arena, the Army would soon find itself as "the odd man out" in the ballistic missile game.

The TCP's findings stimulated the creation of a new missile organization within the Navy. Other than NRL's scientific research work with the Viking program, until 1955 the Navy had steered clear of the ballistic missile environment. There are two general explanations for this. First, liquid rockets—as yet the only large rocket engines available—held little promise for shipboard use. Unwieldy, volatile, and difficult to maintain during operations at sea, liquid-fueled rockets, though conceptually promising, proved logistically elusive. Another argument heard from within the Pentagon was that Navy involvement in ballistic missiles would cast the Navy into a disadvantageous competition with the other two services, both of which already had developing programs well under way.⁶⁶ With the converging

technologies of thermonuclear warheads and inertial guidance systems—the latter arising from the Air Force's Atlas program—they had begun to rethink their position. The TCP report provided the final impetus that brought the Navy to alter its course.

On 17 October 1955, the CNO, Adm Arleigh Burke, established the Special Projects Office. Its sole purpose was to develop a submarine-launched nuclear capable IRBM. Two months later Burke selected a naval aviator, Rear Adm William F. Raborn, to direct it. Raborn was to report directly to the CNO and the secretary of the Navy. The potential implications of this program were clear in the CNO's mind, and the right man had to be found for the job. Of Raborn's selection Burke said, "I wanted a man who could get along with aviators because this [program] was going to kick he-- out of aviators. They were going to oppose it to beat the devil, because it would take away, if it were completely successful in the long run, their strategic delivery capability."⁶⁷ Given that the Navy's midfifties aerial strategic attack capability was hardly the service's mainstay, Burke's reference to aviators could only have inferred one thing: *Air Force* aviators. His vision for the Navy's future IRBM as a strategic attack asset only supports this point.

The Army initially intended to give IRBM development to von Braun's Guided Missile Development Division. However, with President Eisenhower's NSC 1484 announcement in December 1955, which placed ICBMs and IRBMs highest on the national priority list, it soon became apparent that the organization responsible for the Army's missile program required the clout of a general officer. On 1 February the Army chief of staff authorized the creation of the Army Ballistic Missile Agency (ABMA), and moved General Medaris from his position as chief of ordnance into his new role as ABMA's first commander. Medaris's task was clear: to develop Jupiter and take Redstone out of R&D and into production and deployment. To accomplish this, he was granted full authority to "call on any part of the Army" for support.⁶⁸ But Medaris could also expect outside help, for DOD's tasking was clear: ABMA would develop their IRBM together with the Navy.

While the Special Projects Office agreed to work jointly with ABMA on the Jupiter program as the Key West decision had directed, from the beginning Raborn made it clear that the Navy would switch to *solid-fueled* engines just as soon as the technology allowed them to. ABMA—convinced that a practical solid rocket propellant was still long off—was not concerned. Medaris's tea leaves continued to fail him.

In the summer of 1956, the Atomic Energy Commission (AEC) projected that by the early sixties, nuclear warheads would weigh less than one-third their current weights. If so, calculated Raborn, then solid propulsion would finally exist as an alternative fuel.⁶⁹ Raborn convinced the CNO of this likely potential, who in turn convinced DOD. In July the Navy won permission to back out of ABMA's Jupiter program. Three months later, Navy Special Projects Office proposed Polaris, the nation's first plan for a solid-fueled ballistic missile; and it joined Atlas shortly thereafter atop the national priority list.⁷⁰ Polaris would eventually rise to become the third and most survivable leg of America's future strategic triad. "In a technological effort that in some ways was comparable to the Manhattan atomic-bomb program, Raborn [would] put the Polaris missile *system* to sea—in

nuclear submarines—only three years after Sputnik.”⁷¹ While in the end Polaris would pose little challenge to the Air Force’s aerospace concept, what it did do was threaten to kill the Army’s ballistic missile program.

On 26 November 1956, one month following the release of the Polaris plan, Defense Secretary Wilson issued the sixth and final Key West Agreement amendment regarding the organizational control of missiles, apparently putting to rest a contentious issue first raised over 12 years earlier in the McNarney memorandum.

Operational employment of the land-based Intermediate Range Ballistic Missile system will be the sole responsibility of the U.S. Air Force.

Operational employment of the ship-based Intermediate Range Ballistic Missile system will be the sole responsibility of the U.S. Navy.

The U.S. Army will not plan at this time for the operational employment of the Intermediate Range Ballistic Missile or for any other missiles with ranges beyond 200 miles. *This does not, however, prohibit the Army from making limited feasibility studies in this area.* (Emphasis added)⁷²

For the Army, ballistic missiles—like artillery—were tactical weapons after all. But Redstone and Jupiter would not die, for missiles were only missiles when they carried a warhead. Without the warhead, missiles were rockets; and as von Braun had held staunchly in sight from the beginning of his efforts at ORDCIT, rockets could take the Army to space. Furthermore, with the amendment’s innocuous final clause, a crack remained open and exploitable. Not five months after losing the IRBM battle, the focus of ABMA’s future intent became somewhat clear. Medaris and von Braun and company began studies for a big lifter, setting 1.5 million pounds of thrust as its target. Initially called Super Jupiter, this behemoth would soon be renamed Saturn.⁷³ Additionally, ABMA would continue limited feasibility studies in its Jupiter IRBM program.

Interservice competition for missiles were not the only issues posing a challenge to the aerospace concept during this period. Prior to the interservice IRBM battles, the Army and Navy became involved to some extent in satellites as well. While the Navy had left the satellite business alone after 1948, and the Army—despite von Braun’s personal ambitions—had never indulged itself in this area, by 1954 burgeoning civilian interest in the IGY proposal stimulated both services to (re)examine its potential.

The first satellite proposal to appear between the Army and the Navy not surprisingly came from von Braun. In late spring of 1954, he persuaded Army Ordnance to support him in offering a joint satellite venture to the other services. In his report von Braun wrote, “a man-made satellite, no matter how humble, would be a scientific achievement of tremendous impact.” Acknowledging that other countries had similar technology available and that they might soon be able to do the same, he warned, “[i]t would be a blow to U.S. prestige if we did not do it first” (emphasis in original).⁷⁴ Seeking to distribute the plan’s anticipated \$17 million cost, on 15 September von Braun formally offered the Air Force and the Navy participation in a project to launch a five-pound inert slug into orbit.⁷⁵ Yet by this time, the Air Force was already six months into their reconnaissance satellite study. Consequently, they rejected the offer forthright as one that

had no military utility and would only distract them from their long-range interests. The Navy, however, showed more than mild interest.⁷⁶

By early 1955 the Redstone Arsenal and the Office of Naval Research had worked out the details of their plan, dubbed Project Orbiter.⁷⁷ The Army would supply the Redstone booster, the Navy the satellite, tracking, and data analysis.⁷⁸

Also by this time, however, were the emerging policy discussions within the administration concerning the IGY. When NSC 5520 appeared with its intent to emphasize the peaceful and scientific nature of the IGY effort, the Navy began to see the military character of Project Orbiter as threatening the plan's survival. Consequently, they initiated a backup Scientific Satellite Program that proposed using as a first-stage booster NRL's Viking sounding rocket.⁷⁹

With the official announcement of America's intent to launch a scientific satellite during the IGY, the administration formed a committee to select the system that would do the honors. Chaired by Homer Stewart of the Jet Propulsion Laboratory, three proposals were considered. The first was Project Orbiter, the second was the Navy's backup Viking proposal, now called Project Vanguard, and the third was World Series, an Air Force plan with an Atlas booster that was somewhat reluctantly submitted. As the Navy had accurately predicted, World Series and Orbiter proved to be too closely linked with military missile development. Although Orbiter planned to use the Redstone rocket, which was clearly further along in development and consequently showed the most promise of meeting the IGY deadline, the Viking system's civilian flavor, established long before when NRL first began to develop its rocket in 1945, was the more important consideration. After a month of review, the Stewart Committee announced its IGY satellite system selection. Vanguard became America's bid to be the first nation into space.⁸⁰

Interservice challenges during the midfifties failed to have the dramatic effect on the Air Force's aerospace concept that they had during the decade prior. By mid-1955 ARDC had two solid developmental programs rolling in Atlas and WS-117L, and BOMI was getting under way. Together they established the technological push aspect of the Air Force's aerospace concept vector. Nuclear strategic attack and airpower theory continued to provide a comfortable intellectual pull. Furthermore, under Eisenhower there was scant question that strategic attack was the domain of airmen. ICBMs were the Air Force's alone; and from its perspective, the IRBM issue was in two respects somewhat of a blessing. First, naval developments with Polaris directly contributed to weakening the Army's long-standing challenge in land-based long-range missiles. ABMA would continue to resurrect Jupiter as a preferred IRBM system over Thor, and this confrontation would heatedly erupt in a short time. However, from the broader perspective of the Air Force's strategic attack mission, following the November 1954 Key West Amendment, ABMA never again posed a serious challenge to it.⁸¹ Second, the positive effect of the IRBM challenge was the solid fuel technology developments generated by Polaris. These would soon spin off and lead to the Air Force's future ICBM mainstay, Minuteman. As for the IGY satellite interservice challenge, it was no more than a minor skirmish. If von Braun wanted to launch five pounds of

metal into orbit to get there first, so be it. The Air Force was looking toward a 1,500-pound satellite that had military utility.

The importance of the interservice challenge in the IRBM, as well as the satellite, is that "[t]he competition created in the minds of many [outside] observers a negative perception of the ability of the Services to conduct programs associated with missiles and space . . . The atmosphere created by this and other instances of interservice rivalry also had an impact on how the president and the Congress viewed space and defense issues in the late 1950s."⁸² These factors would contribute significantly to the national policy decisions reached in the months following sputnik, which established direct civilian control over the development of space. In the meantime, how the Air Force and the Eisenhower administration approached these last few years still remains to be discussed.

Aerospace Developments (1955-57)

As previously mentioned, in the summer of 1955 the Air Force's aerospace programs were geographically and functionally separated. WS-117L and BOMI were in Ohio under development at WADC. The Atlas program lived on the West Coast at WDD under the command of General Schriever. This functional split and the issues it raised explain the Air Force's tepid interest in the IGY satellite.

World Series, because of ARDC's organizational structure in 1955, was arguably a hindrance for those directly involved. It required cross-division coordination, which for the Atlas program at WDD, was a diversion from its primary and high-priority task. Atlas was, by default, the Air Force's only available launcher big enough to launch an Air Force-sponsored satellite. Not surprisingly, General Schriever was the most vocal critic of the proposal. He felt that accelerating Atlas development in order to launch a scientific satellite for the IGY would decelerate the ICBM program. During late spring of 1955, Schriever and his staff "consistently emphasized that the earliest possible operational availability of an intercontinental ballistic missile was the key objective of the Air Force [missile] program and that an Atlas-launched satellite effort had to hinge on success in that effort."⁸³ Schriever counseled further against becoming involved with the IGY program with the argument that the military aspects of the Air Force's satellite project were more important in the long run.⁸⁴ But pressure from the Air Staff prevailed. On 29 July 1955, the day after the White House announced the nation's intent to put a scientific satellite into orbit by 1958, ARDC under Air Staff direction entered its World Series bid into the IGY competition.⁸⁵ The Stewart Committee's selection of Vanguard was no doubt somewhat of a relief to the Air Force's missile builders in California. What they probably did not know, in light of what transpired in the few months ahead, was that the Stewart decision was arguably a windfall.⁸⁶

Through the summer of 1955 as the World Series proposal was developed, WDD proceeded with its main objective. On 28 April 1955, ARDC approved initial plans for Titan—an ICBM follow-on to Atlas.⁸⁷ Two months later WDD began stand testing the Atlas engine.⁸⁸ By the end of

July, ARDC signed Atlas's operational development plan and forwarded it to the Air Staff for review. The plan called for an acceleration of the program to operational status as quickly as possible, "restricted only by technical considerations."⁸⁹ However, as fall approached, WDD began to feel the TCP-generated pressure for IRBMs; and Schriever's team was compelled to start designing plans for the Air Force's proposal.

Amidst this mission creep, ARDC commander Lt Gen Thomas Power—perhaps recognizing as a result of the in-house deliberations over the World Series proposal that satellite development intimately depended upon a launch platform—began to examine moving the WS-117L program to California. Schriever continued to voice his preference to focus on the ICBM program alone, holding to the position that tasks not germane to strategic nuclear missiles, such as satellites and intermediate-range missiles, promised to interfere with his main assignment.⁹⁰ But on 10 October 1955, Power overruled him and decided to transfer the satellite project from WADC to WDD. The move would commence in February 1956.⁹¹ Thus for the first time in the Air Force's aerospace history, there was organizational acknowledgment of the technical relationship between satellites and missiles that RAND had identified nine and one-half years previously. Satellites would benefit from being out from under a research facility largely devoted to aeronautics.⁹²

Power's October decision generated a corollary incident the following month. While minor at the time, it was significant from the perspective of this study. General Power's logic for marrying the satellite with its planned booster from a system, technological, and operational point of view was sound. Schriever, too, came to recognize this during the coming year and threw his energy behind instituting what became known as the "concurrency approach," whereby both cost and risk was sacrificed to implement parallel (or simultaneous) development of two systems. It was revolutionary for the R&D community, and it laid the foundation for Schriever's ensuing success in building the missile and satellite program for the Air Force. But in November 1955, BOMI's development team approached WDD seeking a similar relationship with the West Coast division. Because BOMI also depended on rocket boost technology, its developers sought the benefits to be gained by reducing task duplication with their California counterparts. Although their logic was consistent with Schriever's concurrency methods, Schriever flatly rejected the idea. The Air Force's only true aerospace program would remain at WADC under the aeronautics division. BOMI's contractors from Bell Laboratories were subsequently prohibited from contacting their counterparts in California.⁹³

Thus, in retrospect, late fall of 1955 arguably marks the beginning of what would later evolve into a space subculture within the Air Force. The significance of these decisions, however, no doubt went unnoticed. Schriever's initial opposition to integrating WS-117L with the Atlas program, as well as his rejection of BOMI's request to join hands, was entirely supportable given the environment he faced. At the time, WDD was focused on America's vitally needed nuclear-capable strategic attack missile. Furthermore, Schriever could see that his division was preparing to expand yet again.

On 14 December, two weeks after Eisenhower placed ICBMs and IRBMs atop the nation's developmental priority list, ARDC issued a directive assigning WDD responsibility for IRBM development as well.⁹⁴ Concurrently, it also approved Schriever's plan for operational deployment of Atlas, directing that 10 systems be delivered to SAC in April 1959 with an ICBM force increase to 120 (80 Atlas and 40 Titan) by January 1960.⁹⁵ Thus by the end of 1955, WDD had "acquired responsibility for building a 'family of missiles,' including the Atlas and Titan ICBMs, the Thor IRBM, and [as well] the WS-117L reconnaissance satellite."⁹⁶

In spite of this sudden growth, General Schriever's concurrency methods worked incredibly well. Expanding his division to include both satellites and IRBMs in fact had little effect on Atlas's progress. WDD was able to continue on track, hitting its planned timetable for Atlas flight testing in June 1957.⁹⁷ WDD would eventually deliver Atlas to SAC only three months later than originally forecasted. It also found room to capitalize on Polaris's solid fuel studies. In early 1956 Schriever submitted initial plans for Minuteman.

As for WS-117L's continued development, Schriever's revolutionary management approach brought even better results. On 2 April 1956, not two months after the program moved to WDD, Schriever's team produced the system's full-scope system development plan. Operational testing for the reconnaissance satellite system would "consist of three progressively more sophisticated payloads: the Pioneer version (photographic and electronic), the Advanced version (photographic and electronic), and the Surveillance version (photographic, electronic, and infrared)." With the initiation of these tests in March 1960, SAC would gain operational control of the system.⁹⁸ WDD envisioned project completion by late 1963, cutting more than a year off the system's originally forecast operational deployment date.⁹⁹ Unfortunately, election politics and Air Force priorities would converge to extend this target.

The fact that WDD submitted this plan seven months prior to Eisenhower's reelection offers the opportunity to make an interesting observation reflective of the Air Force leadership's focus during this time frame. In his April 1956 report, Schriever projected total R&D costs for WS-117L at \$114.7 million. To initiate his development plan according to its timetable, the program required an initial FY 1957 outlay of at least \$39.1 million.¹⁰⁰ Given the election year and Eisenhower's new New Look campaign platform, which (not surprisingly) called for defense budget cuts, the Air Staff was planning accordingly. On 24 July, Air Force headquarters approved Schriever's plan as submitted but with one minor exception: "development was authorized within a funding limitation of \$3 million for [FY] 1957."¹⁰¹ The Air Force called for its reconnaissance satellite program to begin hardware development under a 93 percent funding cut! In stark contrast, while Atlas funding faced similar external political constraints, it fared substantially better. Its FY 1956 budget was \$336 million. Operating on a two-year cycle, WDD submitted a request for \$1.335 billion as it moved into testing.¹⁰² The Air Staff cut this proposal to \$1.135 billion, or only a 15 percent reduction.¹⁰³ Also noteworthy is the fact that these appropriation decisions were not questioned at levels above the Air Force, indicating that as of summer 1956, the Air Force's reconnaissance satel-

lite was not a high national priority either. Ironically, three weeks prior to Air Force leadership signaling with its purse strings where its focus lay, unimpeded over the skies of the Soviet Union the U-2 made its first operational test flight. Within a year Project Aquatone would be providing Eisenhower more than 90 percent of America's intelligence on its cold war adversary.¹⁰⁴

As it was for America's highest decision makers, 1954-56 was an exciting time for the development of the aerospace concept, particularly with its technology push element. After the Teapot Committee concluded in February 1954 that the Air Force could have an operational ICBM in five to six years, Gardner had energized the Air Force to aggressively pursue the ballistic missile. Twining designated Atlas as the service's highest developmental priority in May 1954, one and one-half years before Eisenhower gave it the same at the national level. On 1 July 1954, WDD was established as a special project office to bring Atlas from paper to reality. Under the command of General Schriever, in less than two years, WDD had become a major weapons development center and keeper of the aerospace concept's enabling technologies. Throughout, strategic attack remained WDD, ARDC, and the Air Force's fundamental focus. Airpower theory, still in its form as it emerged from World War II, continued to supply the aerospace concept its intellectual pull.

By early 1957 signs indicated that the Air Force was beginning to make public its organizational interest in space. In February General Schriever, during a public address in San Diego, said "about 90 percent of the developments in the ballistic missile program can be applied to advancing in space, satellites and other vehicles."¹⁰⁵ At approximately the same time, General White, before the House Appropriations Subcommittee, remarked that "missiles are but one step in the evolution from manned high-performance aircraft to true manned spacecraft; and in the forces structure of the future . . . we will have all three systems."¹⁰⁶ There is little evidence to indicate, however, that the considerations and implications of Air Force operations in space from an intellectual perspective were studied much at all.

That being said, in August 1956 Col Martin B. Schofield of the Air War College's Evaluation Division finished an interesting paper titled "Control of the Use of Outer Space." He, like General Arnold 11 years previously, recognized that satellites afforded not only a reconnaissance but also an attack potential. However, being from a different environment, he reached a different conclusion than the former Air Force visionary. Colonel Schofield recommended the establishment of international controls for space. "The presence of a variety of devastating military forces, of many sovereign states, constantly deployed throughout international space may not be conducive to peaceful living. . . . It might be sounder for the United States, while it is an early contender in the exploration of space, to use its position of influence to the best advantage by strongly advocating a form of international control over the use of space."¹⁰⁷ It is unclear if Colonel Schofield was privy to the inner workings of the Eisenhower administration. If he was not, his paper was remarkably insightful. In just five months time, Eisenhower would propose exactly this idea in his 1957 State of the Union address.

"Space for Peaceful Purposes" Goes Public

America elected Eisenhower to a second term in November 1956. With public confidence in his policies, he immediately took further steps in pursuing his strategy for the cold war. On 10 January 1957, while addressing Congress on the state of the union, Eisenhower renewed his Open Skies proposal and expanded the field, calling for the establishment of international control of space.¹⁰⁸ "[The U.S. is] willing to enter any reliable agreement which would reverse the trend toward ever more devastating nuclear weapons; reciprocally provide against the possibility of surprise attack; mutually control the outer space missile and satellite development; and make feasible a lower level of armaments and armed forces and an easier burden of military expenditures."¹⁰⁹

Again, Ike supported his rhetoric with deed. Four days later America's ambassador to the United Nations (UN), Henry Cabot Lodge, presented a memorandum before the UN General Assembly. It represented the world's first proposal for the international control of space technology. Lodge offered "a plan of controls whereby 'future development in outer space would be directed exclusively to *peaceful purposes and scientific purposes*' by bringing 'the testing of [satellites and missiles] under international *inspection and participation*. . .'" (emphasis added).¹¹⁰ The Soviets showed no interest. Cold war arsenals continued to build.

In mid-May American listening posts detected Soviet missile testing in Russia's south-central region. As of yet the United States had been unable to locate the Soviet's ICBM program. Eisenhower immediately authorized a series of U-2 missions to investigate. In early June the pilot of one of these missions altered his planned course to follow a lone set of railroad tracks that in the distance appeared to lead to a construction site. Analysis of the mission's subsequent photographs showed the site to be the Soviet Union's SS-6 ICBM test facility.¹¹¹ Knowing now what to look for, further U-2 flights throughout the summer began to fill in Eisenhower's picture of the Soviet ICBM program. First, no other sites were detected; and though he could not know for sure, it appeared that the Soviet's ICBM capability had been overestimated by his other intelligence sources. Second, now Eisenhower was able to keep close tabs on the SS-6's progress. He knew on 21 August when the Soviets launched their first successful SS-6. He knew that its dummy warhead landed in the Pacific Ocean some 4,000 miles away. He knew of the second test on 7 September and began to suspect that a Soviet satellite might soon follow. What he didn't know was that Khrushchev was on hand for the second test as well. Sufficiently impressed, Khrushchev authorized the third flight—scheduled for early October—to carry mankind's first satellite into orbit around the earth.¹¹²

The American public, however, was unaware of these secrets. On 3 October 1957, with an overwhelming supremacy in airpower, America believed that democracy clearly held the cold war advantage. "It was axiomatic that the United States was both 'better' and mightier than its chief rival. The future belonged to it, at least for the foreseeable American century."¹¹³

Sputnik . . .

The following day sputnik was launched into perpetual free fall. In perhaps the most dramatic display of technological capability the world had yet seen, the Soviets leapfrogged over America's air arm and demonstrated undisputed control of the high ground. To prove the first flight was not a hoax or a fleeting expression of the absolute limit of Soviet technology, the following month they did it again. *Sputnik II* lifted off on 3 November, this time with a 1,120-pound capsule that carried with it the monitoring and life support equipment necessary to sustain its passenger—a mixed-breed terrier named Laika.¹¹⁴ The Soviet Union had seized the world stage, and Khrushchev took full advantage of the opportunity. "We now have all the rockets we need," he told James Reston of the *New York Times*, "long-range rockets, intermediate-range rockets, and short-range rockets." To William Randolph Hearst he boasted, "If necessary, tomorrow we can launch 10, 20 satellites. All that is required for this is to replace the warhead of an intercontinental ballistic rocket with the necessary instruments. There is a satellite for you." "These rockets," he added, "now make it possible to hit a target in any area of the globe."¹¹⁵

History shows these were gross exaggerations. The Soviets in fact had no multiple launch capability and were still years away from precision guidance. "[T]hroughout the entire Eisenhower administration the Soviet Union's *total* arsenal of functional ICBMs would consist of *four* unprotected and highly visible Semyorkas (SS-6s) based at a single, swampy site south of Archangel. All the rest were imaginary."¹¹⁶ Eisenhower was beginning to suspect no less; but to offer the American public credible proof of his suspicions would mean the end of Aquatone, a national asset he could not afford to lose. Consequently, sputnik incited a wave of public hysteria in America. Fueled by Soviet rhetoric and reinforced every 90 minutes as the sputniks passed overhead, many feared that America's technological and military cold war advantages had somehow been squandered. Ike knew better. In his mind sputnik simply made the cold war total.¹¹⁷

. . . and Its Wake

Like Khrushchev, Eisenhower's political opponents also seized the opportunity sputnik presented. Three weeks into November, with two Soviet satellites orbiting aloft unchallenged, Sen. Lyndon B. Johnson (D-Tex.), launched an Inquiry into Satellite and Missile Programs to examine how and why sputnik was allowed to occur. Peeling back the layers of America's space and weapons programs, the hearings dominated the nation's daily headlines for the next two months. Experts and officials from both the civilian and military communities were called to testify. Noticeably absent from Johnson's list of witnesses, however, were some of the administration's key advisors who had been intimately involved in the midfifties formulation of space policy. It is unclear whether their absence was the result of a back room agreement between Eisenhower and Johnson to protect America's secrets, or simply an oversight on the part of Johnson. In

any case, Johnson during these two months scored a tremendous political victory against the Eisenhower administration.

Of particular interest to this study, however, is the general image the military presented during the hearings, as well as the Air Force's particular beliefs about what its future role in space should be. While there were classified hearings held, the following discussion deals only with views offered during public questioning.

Senior Army leadership expressed its dismay with Eisenhower's New Look strategy for stripping the Army of its conventional ground capability at a time when Soviet nuclear parity most demanded it. General Medaris voiced the Army's long-held position on ballistic missiles "praising Soviet wisdom in placing missilery in the artillery instead of the Air Force."¹¹⁸ He suggested that, likewise, ABMA be given control of the US missile fleet: "missiles as an extension of artillery should be in the hands of ground forces."¹¹⁹ Concerning the idea of creating a new space agency—a common topic of discussion in the hearings—Medaris was against it, believing it would cause delays and create confusion.¹²⁰ On this subject, von Braun, who was also brought to testify, interestingly departed from the Army's position. He was critical of DOD's criteria that based rocket development solely on weapon system requirements. Von Braun emphasized that such criteria discouraged the development of large and powerful rockets necessary to boost manned vehicles into space. He suggested the creation of a national space agency, either under the DOD or even completely independent of it, "where competent people would plan a course of action, . . . to put a man into orbit on a returnable basis within the next 5 years, and to have a manned space station, say, in 10 years."¹²¹ On a sobering note, he also offered the Soviet position on the control of outer space. "They consider the control of space around the earth very much like, shall we say, the great maritime powers considered control of the seas, . . . and they say, 'If we want to control this planet, we have to control the space around it.'"¹²² The Air Force held a similar position.

General White, now the Air Force's chief of staff, when offered an open floor from Johnson described his views on the control of space.

I actually foresee the use of weapons in space, both offensive and defensive. I can imagine a satellite being a missile launching platform. It is possible to put out one of those things in space, and have it go over any given spot on the earth and at a given signal, . . . have [it] fire a missile at a given point on the earth, a certain city, for example. I think that if that is possible, that concomitantly there should be developed a defense against this kind of satellite.¹²³

General Schriever also had an opportunity to speak.

Senator Johnson: I want to ask you, what about the Air Force role of putting the Air Force into outer space?

General Schriever: Well, my feeling is this—that from a mission point of view, there is a great deal of similarity in operating in the air, in the atmosphere above the earth, and in operating in space, and so that is No. 1. I think that it normally follows mission-wise. No. 2, from a technical standpoint . . . ballistic missiles . . . [are] the platform for going into space, not only the boosters but the guidance, the re-entry, all parts of it. . . . At least 90 percent of what we are doing in the Air Force ballistic missile program, . . . can be directly applied to an astronautics or space program. . . .

Senator Johnson: And you consider control of outer space extremely important to the free world, do you not?

General Schriever: Well, I certainly do, although I would not be able to give you exactly why in tangible terms, again, a year ago, that I thought perhaps the future battles would be space battles instead of air battles, and I still feel that way about it.¹²⁴

At the conclusion of his testimony, Schriever offered a prepared statement indicating the Air Force's position on the question of a separate space agency. "I believe that any program to develop a separate astronautics agency would result in duplication of capabilities already existing in the Air Force ballistic missile programs, and at a cost in funds and time similar to that already expended on these programs."¹²⁵

Ironically, what emerged after two months of Senator Johnson's far-reaching inquiries was a perception that the military bore significant responsibilities for the Russians beating America into space. Images of a DOD beset with military rivalry and turf battles secured in the minds of Congress the notion that, to paraphrase Georges Clemenceau, French prime minister during World War I, space was too important to be left to the generals. In this regard, the legislative branch came to hold a similar view as the administration. "There was no significant political debate concerning civilian versus military control; both the Congress and the executive branch preferred, and even took for granted, the concept of civilian control."¹²⁶

For Eisenhower's response to sputnik, whatever his intent, he could not avoid reacting to it. Immediately following the second launch, Ike asked Killian (of TCP fame) to become his presidential science advisor and immediately tasked him with his first duty: to address the issue of alternatives for organizing the nation's space program.¹²⁷ Meanwhile, despite the recognition that sputnik "invited another American lurch toward technocracy," Eisenhower stayed the course.¹²⁸ He held his ground, reemphasizing to the public "that it was the 'retaliatory nuclear power' of the Air Force and the Navy that were the nation's first line of defense, not flinging small machines into orbit around the earth."¹²⁹ He maintained that ICBMs and IRBMs were the nation's highest priorities; but on 3 February 1958, to the previous list he added ABMA's Jupiter system and—for the first time—the Air Force's WS-117L satellite system.¹³⁰

Killian, meanwhile, completed his first assignment on 29 December, delivering to Eisenhower his Memorandum on Organizational Alternatives for Space Research and Development. With it the nation's science advisor forwarded two important recommendations. First, he suggested establishing within DOD "a central space laboratory with a very broad character which would permit the conduct of the most basic sort of research as well as R and D, having obvious military objectives." But, more importantly, he gave recognition to the civilian side of space research that until now had been held largely in the shadows of America's space activities. "We must recognize," wrote Killian, "that there are extraordinary opportunities to extend our knowledge of the earth and its environment. . . . It may well be that these kinds of pure, non-practical research objectives may prove to be the most important and in the end the most practical." These, he of-

ferred, could not be conducted under the auspices of DOD. "One obvious way of doing this," he proposed, "would be to encourage N.A.C.A. [the National Advisory Committee for Aeronautics] to extend its space research and to provide it the necessary funds to do so."¹³¹ Killian's recommendations meshed perfectly with Eisenhower's broader strategy goals, and within six months time, both would be implemented.

On 8 February, overruling objections from all three services, Secretary of Defense Neil H. McElroy placed all military space research under civilian control by establishing ARPA "as an operating element paralleling the research and engineering organizations of the military departments." With such powers it appeared initially that ARPA might become a fourth military service, but the agency's appointed director, Roy W. Johnson, held fast to his personal belief that a fourth service only would make DOD's problems worse. Instead, he established ARPA as an oversight agency, dispositioning funds and allocating its projects to the three existing services. In its first year of service, ARPA placed 80 percent of its acquired programs with the Air Force. By comparison the Army garnered 14 percent of the share, the Navy 6 percent.¹³²

On 2 April Eisenhower put into motion Killian's second recommendation. Eisenhower proposed as law the National Aeronautics and Space Administration (NASA) Act of 1958. Using the opportunity to forward his vision for national space policy, Ike presented the legislation in person and said before Congress,

I recommend that aeronautical and space science activities sponsored by the United States be conducted under the direction of a civilian agency, except for those projects primarily associated with military requirements. I have reached this conclusion because space exploration holds promise of adding importantly to our knowledge of the earth, the solar system, and the universe, and because it is of great importance to have the fullest cooperation of the scientific community at home and abroad in moving forward in the fields of space science and technology. Moreover, a civilian setting for the administration of space function will emphasize the concern of our Nation that outer space be devoted to peaceful and scientific purposes.¹³³

The NASA Act was signed into law on 29 July 1958. NASA opened its doors three months later. Left unresolved were critical decisions as to which of the existing programs—then largely all under military control—would be absorbed into the new agency. These choices would be largely the responsibility of T. Keith Glennan, the president of Case Institute of Technology, whom Eisenhower chose as NASA's first administrator.¹³⁴

At one point during the two weeks that followed Eisenhower's legislation proposal to create NASA, handwritten on the back of an envelope, Ike approved the CORONA program.¹³⁵ Organized very much in the image of Aquatone, with Bissell in charge, Ritland (now a brigadier general) as the Air Force liaison, and kept under tightest security, operational plans for the nation's first reconnaissance satellite were agreed upon. The program was carved from the Air Force's WS-117L project by splitting off its photographic subsystem, which would be ready before the others. The only organizational difference between CORONA and the U-2 program was ARPA's involvement. The DOD, with ARPA established as its executor, now had a coequal share of the program's responsibility alongside the CIA. The

Air Force's role in CORONA remained unchanged, providing support and active participation.¹³⁶

Throughout the summer of 1958, the Eisenhower administration worked vigorously to produce an expanded and more definitive version of national space policy. Critical to the debate was the delicacy of articulating the administration's position of peaceful purposes while maintaining America's sovereign right to defend itself militarily. Earlier in the year, Eisenhower had initiated a series of exchanges with the Soviet Union proposing that the superpowers agree to use outer space for peaceful purposes only. The Soviets responded with a counter, advocating among other unacceptable alternatives, a UN "ban on the military use of space."¹³⁷ NSC 5814/1 emerged on 18 August to codify America's position in the stalemate. Of particular interest to the aerospace concept's perspective on the vertical realm, the document established as national policy that "space is divided into two regions: 'air space' and 'outer space.'"¹³⁸ More broadly it recognized, in light of national security requirements within the geopolitical environment of the cold war, that "any use of outer space, . . . whatever the purpose it is intended to serve, may have some degree of military or non-peaceful application." The document further stated that US policies would "have to take into account possible non-peaceful applications in determining the net advantage to U.S. security." But just as significant, NSC 5814/1 held as one of its main policy objectives the desire to secure "[w]orld recognition of the United States as . . . the leading advocate of the peaceful exploitation of outer space."¹³⁹ Roughly three months later, activity within the UN indicated that the United States was on the way to reaching that goal.

On 24 November 1958, Soviet and American positions on internationally sanctioned space controls came to a head before the world's governing body. Both nations submitted rival plans to create an ad hoc UN committee to deal with space matters. Their opposing positions were similar in content to those expressed earlier in the year between the superpowers' respective leaders. In a General Assembly vote of 54-9-18, America's plan was passed—the nine dissenting votes coming from the Soviet bloc. The United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space was created to study space law and explore cooperation possibilities and information exchanges. "This was a significant victory for the United States and presented the international impression of the U.S. as the leading proponent of space for peace and the benefit of all peoples."¹⁴⁰

Epilogue: Enter Aerospace

The first eight months of 1958 heralded the appearance of ARPA, NASA, CORONA, NSC 5814/4, and the word *aerospace*. It remains a matter of dispute as to who within the Air Force actually coined the term. An Air Force civilian writer and editor who prepared feature articles for distribution to base newspapers throughout the Air Force claims he was the first, using the term in an Air Force News Service release on 8 July 1958.¹⁴¹ Robert Frank Futrell, in *Ideas, Concepts, Doctrine*, vol. 1, gives the Air University Research Studies Institute's Dr. Woodford A. Heflin credit for

the term. On 23 February 1958, Heflin published the *Interim Glossary, Aero-Space Terms*.¹⁴² Hyphen or no hyphen, the word caught on quickly, particularly because since sputnik, Air Force leaders were finding themselves often engaged with the public trying to express their views on the Air Force's role in space.

Shortly after *Sputnik II* and four days following the opening of Lyndon B. Johnson's congressional inquiry, General White addressed the National Press Club to which he articulated the most in-depth explanation to date on the Air Force's perspective of the vertical. Describing "the third medium—the medium of space above the earth's surface," White continued,

The compelling reason for the pre-eminence of air power is clear and unchallenged: those who have the capability to control the air are in a position to exert control over the land and seas beneath. . . . I feel that in the future whoever has the capability to control space will likewise possess the capability to exert control of the surface of the earth. . . . We airmen who have fought to assure that the United States has the capability to control the air are determined that the United States must win the capability to control space. In speaking of the control of air and the control of space, I want to stress that there is no division, *per se*, between air and space. Air and space are an indivisible field of operations. . . . It is quite obvious that we cannot control the air up to 20 miles above the earth's surface and relinquish control of space above that altitude—and still survive. . . . The basic philosophy of the United States Air Force as concerns military air power—is the requirement for an offensive force—second to none.¹⁴³

Five months after General White's address, the Air Staff recognized a need to update basic Air Force doctrine to reflect new thinking. On 25 April 1958, Maj Gen Jacob E. Smart, assistant vice chief of staff, sent a letter to the Air University commander proposing that Air Force Manual 1-2, *United States Air Force Basic Doctrine*, be revised. He wrote that new doctrine should reflect the fact that airpower had "moved naturally and inevitably to higher altitudes and higher speeds until it now stands on the threshold of space operation." The letter described how the aerospace concept closely related to the Air Force's current doctrinal position. It also recommended that the new doctrine include the statement: "The positioning of aerospace power geographically and/or astronautically may have dominating significance in peace or war."¹⁴⁴

White argued in an article published in the Winter 1958-59 issue of the Air Force's professional journal, *Air University Quarterly Review*, that a proper perspective on current times was not to view them as the beginning of the space age. Rather, he told his readers, "we are and have been operating in the 'Aerospace Age.'" Looking back through the history of the aerospace concept, beginning 14 years before these words were written, one can argue that White's intriguing proposition may well have sat comfortably with most airmen. But to those outside of the Air Force and to the American public at large, White's words somehow had a hollow ring to them.

Notes

1. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1997), 113.
2. *Ibid.*

3. Matthew J. von Bencke, *The Politics of Space: A History of U.S.-Soviet/Russian Competition and Cooperation in Space* (Boulder, Colo.: Westview Press, 1997), 11; and David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, Colo.: Air Force Space Command, 1995), 29.
4. McDougall, 114.
5. Ibid.
6. Dwight D. Eisenhower, "The Chance for Peace," address delivered before the American Society of Newspaper Editors, 16 April 1953; republished in Martin J. Medhurst, *Dwight D. Eisenhower: Strategic Communicator* (Westport, Conn.: Greenwood Press, 1993), 167-69. Some excerpts also cited in McDougall, 114.
7. Von Bencke, 207; and McDougall, 55. In fact, Joe-4 was a thermonuclear device similar to the one America successfully tested in November the year prior.
8. Thomas D. White, "The Current Concept of American Military Strength," *Air University Quarterly Review*, Spring 1954, 3-4, as cited in Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, vol. 1 (Maxwell AFB, Ala.: Air University Press, 1989), 432.
9. Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 95.
10. Futrell, 489; and Spires, 32. Some refer to the Teapot Committee as the von Neumann Committee, named after its chair, Dr. John von Neumann.
11. Futrell, 490.
12. Ibid.; and Spires, 33.
13. Roy Franklin Houchin II, "The Rise and Fall of Dyna-Soar: A History of Air Force Hypersonic R&D, 1944-1963" (PhD diss., Auburn University, 1995), 72, 77, 90.
14. Col Richard M. Leghorn, memorandum to General Vandenberg, subject: "An Air War Strategy of Disarmament and Obsolescence of the 'Strategic Offensive,'" 27 January 1953, as cited in Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology* (Santa Monica, Calif.: RAND, September 1988), 34.
15. Ibid. Note that Leghorn uses disarmament in the military sense and not in the political sense commonly recognized today. He means physical disarmament through strategic attack of the enemy's capability to wage war.
16. Ibid., 35.
17. Ibid.
18. Curtis Peebles, *Dark Eagles: A History of Top Secret U.S. Aircraft Programs* (Novato, Calif.: Presidio Press, 1995), 19. Camera-equipped bombers represented the mainstay of AF reconnaissance prior to these developments. While sufficient for periphery operations, penetration of the Soviet interior was both extremely risky and, for much of the country, unreachable due to basing and fuel constraints.
19. Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program* (Washington, D.C.: Air Force History and Museums Program, 1997), 5, 6; and Robert L. Perry, *Origins of the USAF Space Program, 1945-1956*, History of DCAS 1961, Air Force Systems Command (AFSC) Historical Publications Series 62-24-10 (Los Angeles: AFSC, Space Systems Division, 1961), 35-36.
20. Perry, 41; and Spires, 36-37.
21. Perry, 42-43.
22. R. Cargill Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, ed. John M. Logsdon (Washington, D.C.: National Aeronautics and Space Administration History Office, 1995), 218-19; and William E. Burrows, *Deep Black: Space Espionage and National Security* (New York: Random House, 1986), 69.
23. Hall, 219; and Burrows, 70.
24. Hall, 219.
25. McDougall, 116.
26. "Meeting the Threat of Surprise Attack," Report to the President by the Technological Capabilities Panel, 14 February 1955, as cited in Davies and Harris, 61.
27. Hall, 220.
28. Burrows, 72-73.

29. Edwin H. Land, Polaroid Corporation, memorandum to Director of Central Intelligence, subject: A Unique Opportunity for Comprehensive Intelligence, 5 November 1954, as cited in Peebles, *Dark Eagles*, 22.
30. Burrows, 73.
31. Ibid., 71.
32. Ibid., 73.
33. Peebles, *Dark Eagles*, 23.
34. Ibid., 25.
35. Ibid., 23.
36. Burrows, 73-74.
37. This idea was introduced during Lt Col Roy Houchin's seminar discussions in February 1999 at the School of Advanced Airpower Studies, Maxwell AFB, Ala.
38. Perry, 47.
39. McDougall, 118.
40. National Security Council (NSC) 5520, "Draft Statement of Policy on U.S. Scientific Satellite Program," 20 May 1955, in Logsdon, 308-9.
41. Ibid., 310.
42. McDougall, 119-20.
43. John Lewis Gaddis, *We Now Know: Rethinking Cold War History* (New York: Clarendon Press, 1997), 245.
44. Walt Whitman Rostow, *Open Skies: Eisenhower's Proposal of July 21, 1955* (Austin, Tex.: University of Texas Press, 1982), 11-13.
45. Ibid., 6.
46. Ibid.
47. Ibid., 8-9. As quoted in Eisenhower's memoirs.
48. McDougall, 128. The Open Skies proposal was eventually signed between the two superpowers on 24 March 1992 under President George Bush.
49. Statement by James C. Hagerty, White House, 29 July 1955, in Logsdon, 200-201.
50. Neufeld, 146.
51. Davies and Harris, 56.
52. Burrows, 72-73.
53. McDougall, 108.
54. Davies and Harris, 42.
55. Medhurst, 38; and Rostow, 3.
56. Medhurst, 74. NRO's History, *The Corona Story*, says "the open skies concept . . . originated with Leghorn." While this information could not be confirmed from my literature review, Leghorn's experience and thoughts on peacetime reconnaissance makes the assertion plausible.
57. Davies and Harris, 42.
58. Peter L. Hays, "Struggling Towards Space Doctrine: U.S. Military Space Plans, Programs, and Perspectives During the Cold War" (PhD diss., Fletcher School of Law and Diplomacy, 1994), 86.
59. Logsdon, 15.
60. "Chronology of Changes in Key West Agreements" (Washington, D.C.: Joint Chiefs of Staff [JCS], Historical Section, 7 February 1958), 20, 14.
61. McDougall, 116, 128.
62. Maj Gen John B. Medaris, US Army, Retired, *Countdown for Decision* (New York: Putnam, 1960), 85.
63. Ibid.
64. JCS, "Chronology of Changes," 22.
65. Medaris, 74.
66. Norman Polmar and Thomas B. Allen, *Rickover* (New York: Simon and Schuster, 1982), 536-37.
67. Ibid., 539.
68. Medaris, 72, 74.
69. Polmar and Allen, 541.
70. McDougall, 129.
71. Polmar and Allen, 535.
72. JCS, "Chronology of Changes," 26.

73. William E. Burrows, *This New Ocean: The Story of the Space Age* (New York: Random House, 1998), 261.
74. McDougall, 119.
75. Perry, 46.
76. Ibid.
77. Ibid., 47.
78. McDougall, 119.
79. Perry, 48; and Hall, 221.
80. Perry, 48-49; and McDougall, 121.
81. For a detailed account of this story, see Michael A. Armacost's *The Politics of Weapons Innovation: The Thor-Jupiter Controversy* (New York: Columbia University Press, 1969).
82. Hays, 90.
83. Perry, 53.
84. Neufeld, 144.
85. Perry, 51; Peebles, *High Frontier*, 8; and Spires, 38.
86. The scientific satellite option continued to exist intermittently throughout the next two years as a back-up, but the Air Force was never seriously interested in participating—see Perry, 49-55.
87. Houchin, 95.
88. Logsdon, 16.
89. Neufeld, 130.
90. Perry, 43.
91. Ibid., 44.
92. Spires, 38.
93. Houchin, 114-15.
94. Neufeld, 147.
95. Ibid., 143.
96. Ibid., 143, 147.
97. McDougall, 129; and Neufeld, 205.
98. *The CORONA Story*, National Reconnaissance Office, (n.d.), 4.
99. Perry, 55-56.
100. Ibid., 56.
101. Ibid.
102. McDougall cites even higher figures for FY 1956 and FY 1958: \$515 million and \$2.1 billion, respectively.
103. Neufeld, 141.
104. Peebles, *Dark Eagles*, 38-39.
105. Futrell, 545.
106. House, *Department of Defense Appropriations for 1958: Hearings before the Subcommittee of the Committee on Appropriations*, 85th Cong., 1st sess., 1957, pt. 1:32, as cited in Futrell, 545-46.
107. Evaluation Staff, Air War College, "Control of the Use of Outer Space," Project AU-7-56-ESAWC, 7 August 1956, 25-29, as cited in Futrell, 548-49.
108. Futrell, 549; and McDougall, 127.
109. "Annual Message to the Congress on the State of the Union," 10 January 1957, *Public Papers of the Presidents, Dwight D. Eisenhower, 1957*, 26, as cited in McDougall, 127.
110. McDougall, 127.
111. Peebles, *Dark Eagles*, 40.
112. Gaddis, 238.
113. McDougall, 7.
114. Burrows, *This New Ocean*, 198.
115. Arnold L. Horelick and Myron Rush, *Strategic Power and Soviet Foreign Policy* (Chicago: University of Chicago Press, 1966), 43-45, 49, as cited in Gaddis, 240.
116. Ibid.
117. McDougall, 227.
118. Ibid., 154.
119. Senate Armed Services Committee (SASC), *Inquiry into the Space and Missile Program (ISMP)*, 1710, as cited in Hays, 126.
120. Ibid.

121. Futrell, 546, 574.
122. SASC, *ISMP*, 597, as cited in Hays, 126. This view of space, forwarded by von Braun as the Soviet perspective, is very similar to a position expressed only days before (29 November) by General White in a speech before the National Press Club, which will be specifically addressed in the concluding section of this chapter. White said that the United States must win control of space because "whoever has the capability to control space will likewise have the capability to exert control of the surface of the earth." Of interest is the contrast between the *tone* of what von Braun forwards as the Soviet position and White's, which is markedly different. How would a Russian have compared these two positions in early 1958?
123. "The USAF Reports to Congress," *Air University Quarterly Review*, Spring 1958, 49.
124. *Ibid.*, 50-51.
125. *Ibid.*, 59.
126. Dr. Robert H. Puckett, "American Space Policy: Civilian/Military Dichotomy," *Air University Review*, March-April 1965, 45.
127. J. R. Killian Jr., "Memorandum on the Organizational Alternatives for Space Research and Development," 30 December 1957, in Logsdon, 629.
128. McDougall, 157.
129. Burrows, *This New Ocean*, 189-90.
130. Peebles, *High Frontier*, 12.
131. Killian, 630.
132. Futrell, 590-91.
133. "Message from the President of the United States Relative to Space Science and Exploration, 2 April 1958," in US House of Representatives, Select Committee on Astronautics and Space Exploration, *Astronautics and Space Exploration* (Hearings on H.R. 11881, 85th Cong., 2d sess., 1958): 3-4, as cited in Puckett, 45-46.
134. McDougall, 196. Worst hit of the three services would be the Army, who was forced to cede ABMA and its Saturn program. Medaris retired in dismay. Von Braun continued pursuit of his lifelong ambition, now under NASA. See McDougall, 195-200 for a detailed account.
135. Kevin C. Ruffner, ed., *CIA Cold War Records: America's First Satellite Program* (Washington, D.C.: Center for the Study of Intelligence, CIA, 1995), 8.
136. *Ibid.* On 19 August 1960, just 110 days after Gary Powers was shot down over Russia ending Aquatone, CORONA had its first fully successful mission after 13 previous attempts.
137. Hays, 141; and McDougall, 179.
138. NSC 5814, "U.S. Policy on Outer Space," 20 June 1958, in Logsdon, 347.
139. *Ibid.*, 347, 353.
140. Von Bencke, 42.
141. Frank W. Jennings, "Doctrinal Conflict over the Word *Aerospace*," *Airpower Journal*, Fall 1990, 52, 56.
142. Futrell, 553. Jennings cites this publication in his article as well.
143. Thomas D. White, "Perspective at the Dawn of the Space Age," address to the National Press Club, 29 November 1957, as cited in Eugene M. Emme, *The Impact of Air Power: National Security and World Politics* (Princeton, N.J.: D. Van Nostrand Co., 1959), 497-99. White's speech is also cited in Futrell, 550.
144. *Ibid.*, 553.

Chapter 5

Summary and Analysis

The first appearance of the word *aerospace* in 1958 belies the fact that the concept had been evolving within the Air Force since the end of World War II. Although it never had a name, the airmen's notion that their operational environment extended beyond the atmosphere was a natural and logical assumption within the framework of their theory. And yet by 1958, national policy, organizations, and law were in place to indicate an alternative environmental paradigm not only existed but also prevailed. In the minds of those outside of the Air Force, air and space did not represent an operational continuum. Rather, space was a different place. Where the preceding three chapters presented the evidence—the story of the aerospace concept's development—the purpose of this chapter is to summarize this evidence and analyze how and why this dichotomy occurred. Specifically, it seeks answers to the following research questions: How did the aerospace concept develop? Did it fail? And if so, why?

The chapter's first section provides an evidential summary that reviews the critical events, issues, and decisions external to the Air Force that shaped the aerospace concept's development. Within this summary a separate analysis of each of the study's contextual themes, as presented in chapter 1, draws out how these environments tended to encourage or discourage the concept's growth through the 14-year period of this study. With the external context understood, the chapter's next section answers the paper's entering research question: How did the aerospace concept develop?

In this section of the chapter, the focus shifts from the external to the internal perspective. From within the Air Force, the analysis specifically tracks the parallel development of the aerospace concept's technology push and intellectual pull elements. Additionally, it will examine the level of focus Air Force leadership apportioned these two elements throughout their development. The intent is to extract critical interrelationships of these three factors upon each other and to establish the evidential foundation with which to enter the chapter's final section and answer the study's ultimate question: Did the aerospace concept fail? And if so, why?

Analyzing the External Contextual Environment

The analysis of the external factors, events, and decisions that shaped the development of the aerospace concept from 1944 to 1958 begins with an examination of the top-down contextual theme. Here the geopolitical environment and the national security strategy decisions are analyzed for their effect on the Air Force's view of the vertical. Next, the discussion moves to general development of aerospace technology (specifically rocketry, nuclear warheads, and satellites). Following that, the horizontal context is explored to draw out how developments within the Army and the

Navy influenced the development of the aerospace concept. Finally, the section closes with a look at how national space policy affected the concept.

Top Down

An emerging and escalating cold war characterizes the geopolitical environment throughout the period of this study. Hardly apparent at the end of World War II, its presence increased as the Soviet Union expanded its power base, cut its ties with the West, and cordoned off its sphere of control. By the end of Truman's presidency, an iron curtain hung around an empire that had acquired the atom bomb, was pursuing nuclear parity, and supporting communist expansion on the Korean peninsula.

During the Eisenhower years, the Soviet threat only intensified. Russia caught and surpassed America's thermonuclear program. In November 1955—six months before the United States—they successfully tested the first air deliverable hydrogen bomb. Furthermore, American reaction to sputnik and the appetite with which the public devoured Khrushchev's post-sputnik rhetoric provide sufficient evidence to indicate that the cold war threat, both real and imagined, had only intensified during the fifties.

The nature of this threat increasingly encouraged both the intellectual pull and the technology push aspects of the aerospace concept. As a geographically vast, industry-based nation that was heavily reliant on a land army for its military strength, Soviet power was potentially well countered by a globally capable air force. Additionally, the missile and satellite technologies being pursued by the Soviet Union, particularly in the 1950s, helped to encourage the technological development of the same at home. Thus from the geopolitical standpoint of the top-down contextual theme throughout the period of this study, the geopolitical context increasingly encouraged the aerospace concept.

The national top-down context developed over time to have a similar influence. During the Truman years, this contextual element had both positive and negative influences; however, with Eisenhower the top-down environment became highly encouraging for the concept's development.

Before 1947 national top-down influence was neutral, offering neither support nor discouragement for aerospace. The nation's civilian leadership was still finding its postwar footing on the international front, while domestically, drawdown and recovery had left little time for national leadership to focus on or even care about fringe research programs under way within the military.

By mid-1947 national leadership began to recognize the emergence of the cold war, and the administration turned to debating an appropriate national security strategy. However, at the same time, America had fallen prey to an economic recession. Consequently, a growing sense of immediacy combined with a limited resource pool to pull the debate's focus inward toward real-time solutions. The strategic, nuclear-capable "air force in being" emerged as a potent but economically viable force structure for national defense. Three years later after the Soviet Union acquired the atom bomb and the North Koreans acquired Seoul, national leadership found additional resources to increase defense funding significantly, some

of which naturally found its way back into the Air Force's R&D programs. However, the Korean War generally continued to keep the nation's security strategy tuned to near-term considerations.

The security strategy decisions of the Truman administration had both negative and positive influences on the aerospace concept. On one hand they discouraged its development in that the strategy's near-term focus and fiscally limited character ran counter to a concept that was both long-range in its vision and expensive to pursue. On the other hand, as the national security strategy validated the airmen's intellectual theory, it supported strongly the concept's theoretical foundation. Thus throughout the Truman years the context of national security strategy and national economics had mixed influence on the aerospace concept.

Eisenhower's national security strategy was similar in character to Truman's in that strategic nuclear attack—or airpower—remained its mainstay. However, by the time Eisenhower assumed office in 1953, a developing technology base, as well as a substantially equipped force in being, together offered him relief from many of the risks inherent with a more forward-looking strategy. Thus Eisenhower was able to take advantage of this opportunity to craft a security strategy that relied much more heavily on technological superiority than Truman's strategy. With strategic attack and technology sharing the New Look's focus, the national top-down environment now strongly supported the aerospace concept's technology push, as well as its intellectual pull element. Eisenhower's national security strategy remained generally unchanged through 1958.

Considering the combined effects of both the geopolitical and the national top-down contexts, with the exception of the late forties when the influence of the national security strategy and economics combined to have somewhat of a restraining effect on its development, the aerospace concept found increasingly fertile ground. In aggregate then, the top-down context, throughout the period of this study's focus, is characterized as increasingly encouraging to the development of the aerospace concept.

Technology

The contextual theme of technology describes the general development of the aerospace concept's enabling capabilities irrespective of the organizational motives that were driving this development. Specifically of interest was the progression of rocket propulsion, nuclear warhead weight and explosive power, and satellite technology. While any technological development in these areas only encouraged the concept, by examining each specifically, a more qualitative assessment emerges.

Rocket propulsion is the most critical technology element of concern. As RAND's first report made clear in 1946, the launch system was intimately linked to all of the developing aerospace technologies of the period. Without the rocket, missiles, satellites, and BOMI did not exist.

Rocket technology experienced accelerating growth throughout the entire period under examination. In December 1944, American rockets could only propel a 500-pound missile 11 miles down range. Yet just over four years later, rocketry had developed enough to put a man-made object into space for the first time in history. By the end of 1952, thrust production

was still far from that required for a nuclear-capable ICBM, let alone a satellite; however, general advancements in rocketry had instilled confidence in missile advocates to begin pursuit of the larger Redstone and Atlas systems.

During the final six years of this study's focus, America's rocket capability expanded from the initial test of a 500-mile capable Redstone system, to the final development state of a nuclear-tipped ICBM fleet and the rocket's proven capability to put a satellite into orbit. *Explorer 1*, America's first satellite, was launched into orbit on 31 January 1958 with ABMA's Jupiter C rocket. Atlas became operational in September 1959. Furthermore, for the first time, solid-fueled rockets emerged during this period as a credible thrust system for larger missiles; and by the end of 1958, realistic plans were in place to build an entirely new class of rockets that in the coming decade would propel American astronauts to the moon.

Unquestionably, throughout the period of study, the primary motivation for rocket development lay in its weapon potential. In this sense, the progress of nuclear warhead technology had significant influence.

Early in the Truman period, the atom bomb was heavy and had limited explosive potential. It therefore offered little encouragement for missile programs due to the unrealistic thrust and accuracy requirements demanded by an operationally effective atomic missile. However, beginning in the early fifties, the pursuit of fusion technology and its promise of lighter and more powerful warheads abruptly reawakened interest in the ICBM. Consequently, developments in nuclear warhead technology, while offering only very limited encouragement to the aerospace concept early on, by the end of Truman's term were starting to aggressively push the concept's development.

Under Eisenhower the effect of these developments became more apparent. Following the AEC's successful test of its first thermonuclear device in November 1952, ballistic missile payload and guidance design requirements were significantly relaxed. This, in turn, breathed new life into missile advocates; and development programs began to proceed with vigor. By 1956 the AEC was forecasting that within seven years a one-megaton warhead would weigh only 600 pounds.¹

As rocket technology advanced, further propelled by breakthroughs in nuclear warhead developments, so too profited satellite development. Prior to 1954 satellite development had failed to proceed beyond the concept phase. Budget cuts in the late forties suspended the Navy's efforts. In the Air Force, while RAND continued to write proposals and studies which expanded the body of knowledge as well as the confidence in this knowledge, hardware was neither built nor tested. Though RAND claimed the potential existed to operationalize a satellite within five years, this potential continued to remain at least five years on the horizon.

By 1954, however, as rocketry advanced, satellite interest also gained momentum. All three services were involved in satellite programs within a year and the civilian scientific community was actively in the picture as well. At the close of this study's period of focus, America had launched three satellites into orbit and was six months away from attempting its first launch of a photoreconnaissance vehicle.

While the influence of the general progress of aerospace enabling technologies on the aerospace concept's intellectual pull element was neutral, all developments had a positive impact on its technology push element. Looking for a trend in this area, rocket propulsion capability tended to improve more or less at a steady pace until the "inject" of thermonuclear technology stimulated acceleration in its progress. As this occurred, the satellite benefited in turn. In sum, because of breakthroughs in warhead design and capability, the technological context throughout the period of this study's focus is characterized as increasingly encouraging to the development of the aerospace concept.

Horizontal

The influence of the horizontal context describes the character of Army and Navy challenges to the Air Force's developing concept of the vertical. While these forces were bureaucratic in nature and solicited bureaucratic responses from the Air Force, they influenced the concept's technology push and intellectual pull elements in similar ways.

Prior to Air Force independence, significant events and decisions from the horizontal context had combined to create a highly encouraging environment for the aerospace concept. While the concept was crafted from the vision of General Arnold, its development within the Air Force—particularly in 1946—was catalyzed in every respect by external interservice challenges. The Army's organizational focus in rocketry was to develop a strategic attack capability. The technology it was pursuing to do this posed both an intellectual and a technological challenge to the Air Force's emerging concept of the vertical. As for the Navy, its interest in rocket propulsion at this point was research oriented, would remain so through the midfifties; and there is little evidence to indicate that the Air Force ever felt threatened by these developments specifically. However, the Navy's move toward satellites sparked a strong response from Air Force leadership, which generated the RAND report and drove the service into its early satellite development.

Without the external influence provided by the other services, by 1947 the aerospace concept arguably would have still been confined to the pages of Arnold's 1945 report to Secretary Patterson. Thus between 1944 and mid-1947, the combined influence of the Army and the Navy's actions highly encouraged its development.

Following the Air Force's independence, the Army's focus on missiles continued to positively influence the concept's development. Unquestionably, the Army's missile program led rocketry's advancement throughout the Truman years. Motivated to pursue ballistic missile research by the desire to extend the reach of its artillery, by the late forties Army rocketry had begun to show promise of delivering the land component a strategic attack-capable weapon system. Despite two amendments to the Key West Agreement specifically directed at constraining Army missile responsibility to tactical systems only, Army Ordnance continued to expand its research.

The man largely responsible for the Army's efforts was von Braun, who was as much a resource for the Army as the Army was for him. While von Braun's personal quest to open the doors to space made his motivation to

pursue rocket development fundamentally different from the Army's, it was his talent, energy, and drive that kept the Army's missile program alive and on track. By the end of 1952, von Braun's Redstone program was preparing to deliver Army artillery a 500-mile-range potential, 100 miles farther than the entire length of the Korean peninsula. The Army's ambitions had stimulated airmen prior to 1947 to defend their strategic attack turf. Throughout the next five and one-half years, the presence and nature of this stimulus only increased in intensity as the Army's missiles ate further and further into the airman's strategic domain. Consequently, from mid-1947 through 1952, the external horizontal influences of the land component's challenge continued to strongly encourage the development of the aerospace concept.

Naval influence during the remainder of the Truman presidency, however, had somewhat of an opposite effect. Early in this period, the Navy's satellite interest continued to positively influence the aerospace concept's development. A year and one-half after its initial challenge, a naval bureaucratic maneuver to claim exclusive military rights to satellite development generated the airman's strongest public statement on space thus far. In January 1948 General Vandenberg released as official Air Force policy, "the USAF, as the service dealing with air weapons—especially strategic—has the logical responsibility for the satellite." The following day the Navy cancelled its satellite program. Thus early in the period, the naval satellite challenge continued to strongly encourage aerospace; but with the program's subsequent departure, this source of encouragement was thereafter removed from the horizontal environment.

In contrast, the Navy's supercarrier campaign to secure a more immediate foothold in the role of strategic attack actually had a discouraging effect on the concept's development. With the Navy's concerted push to build its supercarrier, Air Force leadership was drawn before Congress into a protracted series of hearings. The battle for scarce resources between the two services went on for nearly two years, extending beyond the carrier's cancellation and into the admirals' revolt that followed. The near-term nature of the supercarrier challenge, by drawing Air Force leadership focus to nonaerospace-related budget battles, consequently tended to discourage the aerospace concept's development—perhaps more so than the positive stimulation the concept received from the Navy's satellite ventures.

Characterizing the aggregate influence of the horizontal interservice context between 1947 and 1952, the Army's challenge in rocketry continued to provide strong encouragement for the aerospace concept's development. However, the Navy's decision to abandon satellite development in 1948 and the subsequent negative effect of the Navy's supercarrier proposal combined to decrease the horizontal context's encouraging effect on the aerospace concept's development. While it is impossible to quantify the sum of these effects, from 1947 to 1952 the horizontal context's character can be described as highly encouraging early in the period but decreasingly so thereafter.

The positive influence of the horizontal context during the Eisenhower years only continued to decline. Three factors contributed to this trend. First, the Air Force, as evidenced by the series of Key West Agreement amendments that appeared in the midfifties, had solidified its hold within

DOD on the ballistic missile strategic attack mission. Second, as the Air Force's aerospace programs gathered their own internal momentum, interservice challenges became increasingly less influential in the concept's development. Third, during the post-sputnik Lyndon B. Johnson hearings, the negative military image generated from the midfifties IRBM and IGY satellite turf battles, in part contributed to the establishment of direct civilian control of all of America's space programs.

The horizontal contextual environment that had been so critical to the aerospace concept's emergent success gradually diminished in significance over the 14-year period of this study. Putting this into terms consistent with this analysis thus far, the horizontal context, throughout the course of this study's period of focus, initially was highly encouraging to the development of the aerospace concept but became decreasingly so as the period progressed.

National Space Policy

The emergence of a national space policy in the midfifties brought this contextual theme to bear for the first time thus far in the study. While its influence on the aerospace concept was new, its eventual effects—wholly discouraging—were by far the most significant.

Prior to sputnik two aspects of national space policy had emerged that were relevant to the Air Force's perspective of the vertical. The first was the creation of Project Aquatone, which effectively took control of strategic reconnaissance away from the Air Force. The U-2 was certainly not a space platform; but its recognized follow-on system, WS-117L, was. Consequently, the precedence set by Aquatone's organizational structure, which clearly posited the Air Force in a supporting role, had significant discouraging ramifications with regard to the Air Force's future role in space.

The second aspect of Eisenhower's pre-sputnik space policy was its signaled intention, in NSC 5520, to publicly establish the peaceful purposes of America's IGY satellite in order to promote the concept of the freedom of space. One perspective on this policy is that it was strictly designed to protect America's future reconnaissance satellite operations. While satellite reconnaissance was clearly a critical element of the policy, this view is somewhat limited in that it fails to account for the broader aspects of Eisenhower's cold war strategy, which were apparent in his 1953 Cross of Iron speech. The evidence is not conclusive, but it tends to strongly indicate that Eisenhower was as sincere in his peaceful intentions for outer space as he was in his determination to protect his developing satellite reconnaissance capability. While attempting to establish the freedom of space as an international norm was a safe entering gambit given the cold war environment, as of May 1955 (when NSC 5520 was signed), the Air Force was projecting the WS-117L to be 10 years away from operational employment. Further supporting the broader perspective of Eisenhower's strategy for peace is the fact that his Open Skies proposal was both initially conceived and then offered to the Soviets after NSC 5520 was established. Ike's proposal, had the Soviets accepted, would certainly have secured a major precedent for the freedom of space. Ironically, however, it would have also made the requirement for a reconnaissance satellite ob-

solete. Thus one can conclude that easing cold war tensions and securing a road to peace was a higher priority in Eisenhower's space strategy than simply protecting the role for reconnaissance satellite operations. Ike's plan afforded America the moral high ground, as well as a win-win position. This plan gave the strategy its brilliance. However, for the aerospace concept that was fundamentally rooted in the notion of strategic attack from or through the operational environment that included space, a policy of space for peaceful purposes was fundamentally discouraging.

Eisenhower had created "a policy subtle in conception and delicate in execution."² In January 1957 the United States publicly proposed the notion of space for peaceful purposes before the UN. The Soviets rejected it. Sputnik ensured it.

In the months following the launch of sputnik, what was largely conceptual in the mind of Eisenhower and his policy advisors quickly became ensconced in organizational structure, legislation, and a more mature national space policy. The creation of the Advanced Research Projects Agency (ARPA) within DOD established direct civilian control of all military space development. It was an unprecedented arrangement. The NASA Act secured Eisenhower's intent to establish the peaceful and scientific purposes of America's civilian space program. CORONA's approval ensured the national space program's secret aspects would also remain under civilian control. Finally, NSC 5841 established in national policy the environmental paradigm that recognized the vertical not as an aerospace continuum but rather as two distinctly different regions—air space and outer space. In just four years time, national space policy had evolved by the end of 1958 to make the Air Force's concept of the vertical largely irrelevant. The influence of the national space policy context, during the final four years of this study's period of focus, was fundamentally discouraging to the development of the aerospace concept.

The analysis thus far suggests that the external contextual environment, with the exception of national space policy, and a discouraging perturbation in the national top-down context during the last term of President Truman, otherwise offered strong encouragement for the airman's developing perspective on the vertical. Bureaucratic processes within the horizontal context played a significant part in establishing the aerospace concept's emergence and continued to support its development, though increasingly less so, throughout the 14-year period of this study. As the encouraging aspects of the horizontal context receded, however, the influence of the cold war and developments in technology—specifically the breakthroughs in thermonuclear research—stepped in to continue to offer increasing support for the airman's developing perspective of the vertical. By mid-1953, Eisenhower's New Look strategy entered to encourage its development even more. With this external context established, we can now approach this study's entering research question.

How Did the Aerospace Concept Develop?

In this section the focus turns to the bottom-up contextual environment. Exploring the interrelated paths of the aerospace concept's tech-

nology push and intellectual pull elements, the discussion describes their evolution as well as the role that Air Force leadership focus played in this process. The analysis, presented according to the study's three historical periods, thus describes how the aerospace concept developed.

1944-47

By as early as November 1945, the bottom-up context within the Air Force saw the external horizontal challenges from the Army's burgeoning missile program combine with General Arnold's aerospace vision to stimulate the concept's actual gestation. The year that followed saw it bloom; and as the Air Force approached its independence, all three elements critical to the concept's development—its technology push element, its intellectual pull element, and the focus of Air Force leadership—were actively engaged with one another.

Pushing the nascent concept out of its womb were the enabling technologies introduced in RAND's groundbreaking satellite report and Convair's early rocket-propelled ballistic missile study. To encourage this push, an even stronger intellectual pull element was evident. Arnold had successfully passed his vision on to the next generation of Air Force leadership; and airpower theory was alive and well, still enjoying the momentum of its recent success in the war. Finally, clearly fostering the development of the aerospace concept's symbiotic push/pull elements was the critical nourishment it secured from the focus of Air Force leadership. Senior-level decisions had directed the establishment of the concept's technological programs and had bureaucratically maneuvered to strengthen the service's hold on the strategic attack mission. But also apparent within the Air Force by this time were two issues that had potential to weaken the emergent concept.

The first of these was the fact that a less ambitious vision existed. Where Arnold's vision fully included space, von Kármán's 10-year look into the future—published in his *Toward New Horizons* report—only scratched it. The Air Force's chief scientist had assessed that rockets and satellites would be inconsequential, and therefore recommended that service research should concentrate instead on jet propulsion and aircraft technology. Dr. von Kármán's vision was less ambitious, more realistic, and one that no doubt sat more comfortably with the institution. Nevertheless, as evidenced in 1946 by the service's move into rocket-propelled missiles and satellites, there were indications within the Air Force—as it approached its independence—that support for Arnold's broader aerospace vision was growing.

Along the aerospace path, however, arose an additional issue that would hinder the concept's development in coming years. It concerned the relationship between the satellite and the missile. In April 1946 RAND's groundbreaking report, *Preliminary Design of an Experimental World-Circling Spaceship*, recognized that the rocket formed an intimate technological connection between the two. The Air Force's think tank argued that because the only difference between a long-range missile and a satellite was the type of payload the rocket carried in its nose, the two systems should thus develop together. However, prior to the summer of 1947, the infancy

of the service's missile and satellite studies had yet to bring the technological aspect of this issue to the table. But there was an intellectual aspect to it as well—signs of which, prior to Air Force independence, had already emerged.

Consistent with the airman's theory in 1947, indications were apparent within the Air Force that missile development would take priority over the satellite. The primary motivation to pursue rocket technology, if it was to be pursued at all, was to develop a long-range weapon; and while the RAND report had indicated the satellite's ultimate potential as an orbiting weapons platform, this capability was seen as still many years away. Concentrating on the interim, RAND pushed for its use as a reconnaissance platform. In this regard, though clearly supportive of the theory of strategic attack, the satellite came to be seen as just that—supportive. LeMay wrote in September 1946, "the long range future of [the Air Force] lies in the field of guided missiles." Satellites, on the other hand, had been defended by the service with the argument that they were an extension of strategic airpower. It was a position wholly consistent with airpower theory and the aerospace concept.

Despite the emergence of these two issues—an alternative vision and the relationship between the satellite and the missile—as the Air Force approached its independence, the aerospace concept was off to a healthy start. It had risen from the combined influence of the horizontal context and Arnold's far-reaching vision and had grown in strength from the strong intellectual pull of Arnold's vision and airpower theory. Furthermore, the concentrated focus of Air Force leadership had pushed to establish the concept's early technologies. Thus between 1944 and mid-1947, the emergent success of the aerospace concept—spurred in large part by the highly encouraging influence of the horizontal context—is attributable to the concentrated focus of Air Force leadership on both its push and pull elements.

1947-52

With Air Force independence came five and one-half years of stagnation for the aerospace concept, in part due to the discouraging influence of the national top-down context. The environment facing Air Force leadership beginning in summer 1947 was complex and demanding, and it pulled leadership focus away from aerospace. Foremost on the Air Force's plate were organizational issues inherent with establishing the necessary bureaucracy upon which it could independently function. Simultaneously, Air Force leaders found themselves immersed in reality. Building a nuclear capable strategic attack force in being and working to secure and maintain an equal footing astride its older siblings was challenging enough. That these efforts occurred within a severely constrained fiscal environment made them daunting. And finally, after three years of energy-draining focus on these matters, just as signs began appearing that the Air Force's leaders might finally be in sight of some breathing room, in June 1950 America became immersed in three more years of international conflict. Nourishing the development of a concept still far off into the future naturally found little support within such a climate.

Almost immediately the aerospace concept's technology push element slowed to a crawl. Budget reductions, which began in the summer of 1947 and continued for another three years, took their toll on all Air Force R&D programs. However, those specifically supporting aerospace became the earliest casualties. Convair's early ballistic missile study was cancelled in July 1947 as soon as the budget crunch hit, although an increased resource flow which began following the opening of the Korean War, offered room again in early 1951 to reopen it. Satellites, interestingly, despite having lost its only rocket connection for three and one-half years, managed to garner the funding for RAND to at least continue its studies. However, in the interim, theory developments within the concept's intellectual pull element would find that satellite stock had fallen sharply against the ballistic missile. This discussion looks at what happened to the concept's vision.

Although the context justified it, Air Force leadership in the five years following service independence indicated a growing preference for von Kármán's vision over Arnold's. Evidence of this trend comes from the resource decisions made during this period. First was AMC's December 1947 report recommending that satellite studies continue but that funding priority should be assigned to missile development, which at this point, with Convair's ballistic missile study dead, were all air-breathing cruise missiles. Consequently, these programs, more supportive of von Kármán's vision than Arnold's, were kept alive throughout the lean period. When Convair's Atlas program was reinitiated in 1951, institutional priorities continued to favor the jet-powered cruise missile. Compare the funding allocations between 1951 and 1954 for Atlas versus the air-breathing Navaho and Snark systems. Where Atlas received \$26.2 million over this period, Navaho and Snark were allocated more than \$225 million apiece.³

Further evidence of the decline in support for Arnold's vision may be inferred from the visionary insights drawn from General Vandenberg's February 1951 *Saturday Evening Post* article. In January 1948 Vandenberg had taken a firm public stance to protect the Air Force's satellite interest from naval encroachment. However, to the American public three years later, while he addressed the future of jet propulsion and supersonic aircraft, he mentioned nothing of the Air Force's potential future in space. General Vandenberg's perspective, as the Air Force chief of staff in 1951, was decidedly "aircentric."

The only aspect of the aerospace concept that showed signs of development throughout this period was the appearance in the early 1950s of two interesting arguments that related to the concept's intellectual foundation—airpower theory. While both concerned the future role of reconnaissance in the Air Force, one employed satellites to burst through the theory's fundamental boundaries, the other argued that airplanes could expand the theory within them.

The first, published in October 1950, was Kecskemeti's argument stressing the political leverage that satellite reconnaissance potentially offered. The RAND psychologist posited that the ability to gather visual information over Soviet territory, if they knew about it, would "increase the effectiveness of deterrence, [and] contribute to the effectiveness of direct

political pressure upon the Soviet Union." It was a provocative concept, especially from an airpower theory standpoint that found its leverage in nuclear strategic attack. Kecskemeti's paper consolidated and synthesized a growing advocacy position from within RAND motivated by the think tank's desire to generate more interest for satellites within the Air Force. But his piece was beyond the bounds of conventional thought. It had little to do with the standard role of military reconnaissance for targeting intelligence in support of strategic attack, and it was consequently ignored.

The second argument emerged in June the following year from Colonel Leghorn and rose to the highest levels of the Air Staff. Crafting the Air Force's first argument for the importance of Pre-D-Day, peacetime, strategic reconnaissance, Leghorn's position—unlike Kecskemeti's—was firmly rooted in the service's foundational theory. Furthermore, in June 1951 Leghorn saw scant value for satellites in support of this role, advocating instead—both in terms of cost and availability—the development of air-breathing systems (although in less than two years time, he would amend this position).

Thus from an intellectual perspective, despite the technological relationship between satellites and ballistic missiles, by the end of 1952 the two had taken clearly divergent paths. RAND had ceased advocating the satellite's future potential as a weapon, while Leghorn argued that as a reconnaissance platform, the satellite offered little value added.

During the five and one-half years following Air Force independence, the aerospace concept had found itself in difficult terrain. As a result, at the end of 1952, the Air Force's technological capacity to enable the aerospace concept remained much in the same form as when it entered the period—still largely on paper. The intellectual position that supported it had actually receded, with Arnold's vision having lost significant ground and Leghorn's argument emerging to downplay the role of satellites in strategic reconnaissance. Thus, to summarize this period, the development of the aerospace concept between 1947 and 1952 saw its push element stagnate and its pull element weaken, both conditions largely the result of top-down and bottom-up contextual forces that justifiably drew leadership focus to more pressing issues of the time.

1953-58

During the Eisenhower years, on one hand the visible aspect of the aerospace concept, the development of its technology push element, sat in stark contrast to the previous five and one-half years. The huge resurgence in the Air Force's aerospace programs during this period came primarily, if not solely, from the combined influence of two external contextual environments. First was the breakthrough in thermonuclear technology that occurred two months before Eisenhower took office. Second was the highly encouraging nature of the top-down context, to which cold war and Eisenhower's New Look strategy both contributed. On the other hand, the concept's more obscure intellectual pull element was left behind in the wake.

Within a year after the New Look was established as national policy, Gardner had energized the Air Force's ICBM program, bringing Atlas to

the top of the Air Force's developmental priority list and establishing the WDD as its organizational caretaker. The satellite also jumped off of its paper existence due in part to Leghorn's reversal in January 1953 of his earlier position concerning its reconnaissance utility and in part due to RAND's tireless advocacy for it. Nevertheless, for the time being, its developmental relationship with ICBM still went unnoticed within the Air Force. It was geographically separated from and sat significantly lower in developmental priority than Atlas. BOMI found interest and support within this R&D climate to emerge as the Air Force's first truly aerospace system.

By the summer of 1955, signs were evident that the focus of Air Force leadership had returned in force to the aerospace concept. Unfortunately, it seemed to concentrate strictly on the concept's technology push element. In response to the TCP report and NSC 5520, the Air Staff directed the satellite program to submit an IGY proposal, and pressure was brought to bear on WDD to develop plans for an IRBM. In October 1955, two months prior to Eisenhower bringing missile development to the top of the nation's priority list, the Air Force finally recognized that the satellite should be united with its launch vehicle. Within six months, General Schriever was commanding one of America's most ambitious weapons research facilities.

But as for recognizing the winds of change apparent in Eisenhower's emerging space policy by this point, there was little evidence to indicate that Air Force leadership had grasped the policy's significance. Despite having strategic reconnaissance pulled out from under its care, the Air Force continued to push the U-2's satellite follow-on to the side of the plate. In the summer of 1956, WS-117L's development plan was approved but with a 93 percent cut in its required funding. Furthermore, there was nothing throughout this period to support the notion that airmen were intellectually considering the potential implications that space operations might bring. The Air Force was experiencing a huge growth in its aerospace technologies into which the service's leadership was actively engaged, but airpower theory and the aerospace vision were left utterly alone. Until late 1957 Arnold's vision of 12 years prior continued to be the Air Force's most far-reaching perspective into the future. While Eisenhower was developing his strategy of space for peaceful purposes, the Air Force continued to build its missiles.

However, sputnik noticeably changed that in November 1957 when General White broke the silence in his address before the National Press Club to publicly state that "there is no division, per se, between air and space." The two were "an indivisible field of operations." White's speech was well crafted and indicated, at least, that he had been thinking about aerospace. But at the Lyndon Johnson hearings, his chief developer seemed somewhat surprised by Johnson's question about the importance of controlling outer space. Schriever thought it important, but was unable to explain "exactly why in tangible terms."

The Eisenhower years were by far the most dramatic in the aerospace concept's development. The technological developments that occurred during this six-year period represent perhaps the most important six years in Air Force history. But while Air Force leadership focused on its

programs, the concept's intellectual development fell by the wayside. When sputnik called and the complete hand had to be laid on the table, the aerospace concept came off as short on substance. In sum, the development of the aerospace concept from 1953 through 1958 was motivated primarily from the external technology developments and a highly encouraging top-down contextual environment. Both combined to foster dramatic development in the concept's push element. Subsequently, leadership focus continued to motivate this development; but the concept was weakened overall because leadership focus neglected the concept's pull element.

Did the Aerospace Concept Fail?

Not completely. Actually, the aerospace concept's report card is somewhat reflective of its developmental state when it arrived. Technologically, the Air Force—as of 1958's conclusion—was still very much involved in America's space program. Within the military ARPA had allocated 80 percent of its FY 1958 space research funding to the Air Force. The service also had an active role in CORONA, if only in a supporting sense. Between the three services, there was no question that the Air Force had come out on top. Thus in a technological sense, the strength of its R&D program coming into the study's final year carried enough momentum to enable the Air Force to keep a reasonably substantial hand in America's burgeoning space program.

Nor did the concept entirely fail within the Air Force. In 1959 the service adopted as its official slogan, "U.S. Air Force—Aerospace Power for Peace."⁴ By the end of that year, *aerospace* was entered into basic Air Force doctrine, codifying the term as the "operationally indivisible medium consisting of the total expanse beyond the earth's surface."⁵ Both of these developments indicate that the aerospace concept, at least in name, had not completely failed.

Unfortunately, these actions did little to fill the concept's deeper intellectual void. Throughout the period of this survey, there was little evidence to indicate that the Air Force was actively engaged in asking the broader intellectual questions of how space fits in to airpower for the good of the Air Force, much less for the good of the nation.

Thus partial success of the aerospace concept's arrival is significantly diminished in two respects. First is the obvious fact that national policy, legislation, and infrastructure were in place by 1958 to indicate that air and space would not be considered a continuum—operational or otherwise. Second, because the Air Force had failed to think through and intellectually justify the aerospace concept, when it finally arrived for public consumption, the concept had a hollow ring to it. Far too little was offered far too late. Standing beside the nation's space policy, airpower had a ceiling.

Notes

1. Norman Polmar and Thomas B. Allen, *Rickover, Controversy and Genius: A Biography* (New York: Simon and Schuster, 1982), 541. One megaton equates to one million tons

of TNT. By comparison the atom bomb dropped on Nagasaki weighed 10,800 pounds and delivered an explosive equivalent of 23,000 tons of TNT.

2. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1997), 194.

3. Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 77.

4. Frank W. Jennings, "Doctrinal Conflict over the Word Aerospace," *Airpower Journal*, Fall 1990, 46-58.

5. Air Force Manual 1-2, *United States Air Force Basic Doctrine*, 1 December 1959, 6, as cited in Johnny R. Jones, *Development of Air Force Basic Doctrine* (Maxwell AFB, Ala.: Air University Press, April 1997), 9.

Chapter 6

Conclusion

Forty years span the interregnum between the appearance of General White's aerospace vision and ongoing developments within the Air Force today to effect the cultural and operational integration of air and space. Though much has changed since aerospace first appeared to describe, in a word, the notion that air and space represent an operational continuum, two significant continuities remain to suggest that the Air Force's aerospace plans will be difficult to implement.

The first of these is that the aerospace concept, both in its technology push and its intellectual pull aspects, remains fundamentally unchanged in character from the past. While Air Force space assets are certainly much more robust than in 1958, the Air Force's technological capacity to enable an operational continuum in the vertical remains scant. In 1963 Secretary of Defense Robert S. McNamara's fiscal conservatism resulted in the cancellation of the Air Force's only true aerospace system, its BOMI program, by then renamed Dyna-Soar. More importantly, the intellectual foundation upon which the aerospace concept rests remains fundamentally unchanged. Airpower theory, despite the dramatic developments it has undergone in the past 40 years through the experiences of Vietnam and Operation Desert Storm, in its most basic sense remains deterministically focused where it has always been—on the application of military force through the vertical to any point on the globe. What was yesterday called strategic attack, in today's lexicon is expressed as "find, fix, track, target, engage, and assess."

The second significant similarity from the past is the unchanged character of America's national space policy. Despite the end of the cold war, which was arguably won in part because of this policy, the original framework crafted by Eisenhower still stands. The language of the latest version is strikingly familiar. "The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity. 'Peaceful purposes' allow defense and intelligence-related activities in pursuit of national security and other goals."¹

The policy, legislation, and organizational architectures that curtailed the Air Force's aerospace concept 40 years ago remain largely in place; and because the aerospace concept remains intellectually similar to its early form, this policy continues to discourage it.

Wholly dissimilar from the context of 1958 is today's top-down environment. The cold war, which supported the development of the airman's view of the vertical with the nature of the threat it presented, is now embedded in history. In its place has appeared a threat horizon more gray and opaque than it was when bipolarism described, with black and white clarity, the character of yesteryear's geopolitical context. With this change, so too has America's national security strategy naturally evolved. Engagement and Enlargement bears scant relation in its name or its idea to Massive Retalia-

tion. If trends may be implied, today's national security strategy seems much more congruent with space for peaceful purposes than it does with an aerospace concept rooted in a modern-day variant of strategic attack.

Third, and perhaps most important, space itself is different today than it was 40 years ago. The blank page that faced Air Force visionaries and Eisenhower in the 1940s and 1950s is no longer pristine. Once the untouched domain of two opposing superpowers in a bipolar world, exclusive to its governments and their militaries, today space has opened its doors to a host of varied interests. Nations around the globe have investments there. Furthermore, space has become commercialized and is catalyzing the development of a global economy.

Within the Air Force, today's resurgent focus on aerospace continues to intuit that air and space integration is a natural and logical step in the evolution of airpower. These intuitions are naturally force application centric, bound, and defined by a theory that espouses the application of military force through the vertical as its central theme. But the world in which airpower theory was born has changed. The environment the aerospace concept encompasses is more complex and interdependent with the world than it was during the period when the concept was first developed.

America currently enjoys a position of global hegemony in a strategic pause. Likewise, its Air Force enjoys an overwhelming force advantage over any other in the world. If the integration of air and space is of paramount importance to the Air Force, perhaps it is time for airmen to reexamine their theory. Perhaps it is time to expand the theory beyond the application of military force through vertical and into an intellectual region that accounts for the economic and geopolitical considerations that are becoming increasingly tied to the aerospace environment. President Eisenhower suggested an interesting starting point by implicitly recognizing in his space policy that the essence of aerospace power might not be the ability to attack any point on the globe. Rather, its essence might be described better as perspective. Whether this fundamental paradigm shift would lead to a broader understanding of aerospace power's role in the affairs of the world is unclear. But the idea offers an intriguing area for further study.

There was a time, roughly 100 years ago, when naval military theorists first understood that a much broader relationship existed between the seas and the affairs of the globe than had been previously recognized. From this awareness there came a significant expansion of sea power theory and a corresponding development of a national maritime strategy. Perhaps the move to integrate air and space would be better justified within today's context if it were preceded with an expansion of aerospace power theory and the development of a national aerospace strategy that accounts for the expanding role of the aerospace environment in today's global affairs. Naval thinkers ushered in the maritime vision a century ago. Perhaps it is time for airmen to lift the ceiling on airpower theory.

Notes

1. National Space Policy, 16 September 1996, n.p.; on-line, Internet, 16 February 1999, available from <http://www.aiaa.org/policy/nat-space-policy.html>.

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